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AN ANALYSIS OF THE AQUATIC INVERTEBRATES AND HABITAT OF STREAMS IN THE ST. REGIS RIVER WATERSHED

July-August 2001

FINAL

A report to

**The Montana Department of Environmental Quality
Helena, Montana**

by

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INTRODUCTION

Aquatic invertebrates are aptly applied to bioassessment since they are known to be important indicators of stream ecosystem health (Hynes 1970). Long lives, complex life cycles and limited mobility mean that there is ample time for the benthic community to respond to cumulative effects of environmental perturbations.

This report summarizes data collected in late July and early August 2001 from sites on eleven streams in the St. Regis River watershed, Mineral County, Montana. Aquatic invertebrate assemblages were sampled by personnel of the Montana Department of Environmental Quality (DEQ). Study sites lie within the Northern Rocky Mountain ecoregion (Woods et al. 1999). A multimetric approach to bioassessment such as the one applied in this study uses attributes of the assemblage in an integrated way to measure biotic health. A stream with good biotic health is "...a balanced, integrated, adaptive system having the full range of elements and processes that are expected in the region's natural environment..." (Karr and Chu 1999). The approach designed by Plafkin et al. (1989) and adapted for use in the State of Montana has been defined as "... an array of measures or metrics that individually provide information on diverse biological attributes, and when integrated, provide an overall indication of biological condition." (Barbour et al. 1995). Community attributes that can contribute meaningfully to interpretation of benthic data include assemblage structure, sensitivity of community members to stress or pollution, and functional traits. Each metric component contributes an independent measure of the biotic integrity of a stream site; combining the components into a total score reduces variance and increases precision of the assessment (Fore et al. 1995). Effectiveness of the integrated metrics depends on the applicability of the underlying model, which rests on a foundation of three essential elements (Bollman 1998). The first of these is an appropriate stratification or classification of stream sites, typically, by ecoregion. Second, metrics must be selected based upon their ability to accurately express biological condition. Third, an adequate assessment of habitat conditions at each site to be studied is needed to assist in the interpretation of metric outcomes.

Implicit in the multimetric method and its associated habitat assessment is an assumption of correlative relationships between habitat parameters and the biotic metrics, in the absence of water quality impairment. These relationships may vary regionally, requiring an examination of habitat assessment elements and biotic metrics and a test of the presumed relationship between them. Bollman (1998) has recently studied the assemblages of the Montana Valleys and Foothill Prairies ecoregion, and has recommended a battery of metrics applicable to the montane ecoregions of western Montana. This metric battery has been shown to be sensitive to impairment, related to habitat assessment parameters, and consistent over replicated samples.

Habitat assessment enhances the interpretation of biological data (Barbour and Stribling 1991), because there is generally a direct response of the biological community to habitat degradation in the absence of water quality impairment. If biotic health appears more damaged than the habitat quality would predict, water pollution by metals, other toxicants, high water temperatures, or high levels of organic and/or nutrient pollution might be suspected. On the other hand, an "artificial" elevation of biotic condition in the presence of habitat degradation may be due to the paradoxical effect of mild nutrient or organic enrichment in an oligotrophic setting.

METHODS

Aquatic invertebrates were sampled by Montana DEQ personnel from July 23-26 and August 1-3, 2001. Nineteen sites on eleven streams were sampled. Site locations and sampling dates are indicated in Table 1. The sampling method employed was that recommended in the Montana Department of Environmental Quality (DEQ) Standard Operating Procedures for Aquatic Macroinvertebrate Sampling (Bukantis 1998). In addition to aquatic invertebrate sample collection, habitat quality was visually evaluated at each site and reported by means of the habitat assessment protocols recommended by Bukantis (1998).

Evaluated habitat features include instream conditions, larger-scale channel conditions including flow status, streambank condition, and extent of the riparian zone. Scores were assigned in the field to each habitat measure, and these scores were totaled and compared to the maximum possible score to give an overall assessment of habitat.

Aquatic invertebrate samples and associated habitat data were delivered to Rhithron Biological Associates, Missoula, Montana, for laboratory and data analyses. In the laboratory, the Montana DEQ-recommended sorting method was used to obtain subsamples of at least 300 organisms from each sample, when possible. Organisms were identified to the lowest possible taxonomic levels consistent with Montana DEQ protocols.

To assess aquatic invertebrate communities in this study, a multimetric index developed in previous work for streams of western Montana ecoregions (Bollman 1998) was used. Multimetric indices result in a single numeric score, which integrates the values of several individual indicators of biologic health. Each metric used in this index was tested for its response or sensitivity to varying degrees of human influence. Correlations have been demonstrated between the metrics and various symptoms of human-caused impairment as expressed in water quality parameters or instream, streambank, and stream reach morphologic features. Metrics were screened to minimize variability over natural environmental gradients, such as site elevation or sampling season, which might confound interpretation of results (Bollman 1998). The multimetric index used in this report incorporates multiple attributes of the sampled assemblage into an integrated score that accurately describes the benthic community of each site in terms of its biologic integrity. In addition to the metrics comprising the index, other metrics, which have been shown to be applicable to biomonitoring in other regions (Kleindl 1995, Patterson 1996, Rossano 1995) were used for descriptive interpretation of results. These metrics include the number of "clinger" taxa, long-lived taxa richness, the percent of predatory organisms, and others. They are not included in the integrated bioassessment score, however, since their performance in western Montana ecoregions is unknown. However, the relationship of these metrics to habitat conditions is intuitive and reasonable.

The six metrics comprising the bioassessment index used in this study were selected because, both individually and as an integrated metric battery, they are robust at distinguishing impaired sites from relatively unimpaired sites (Bollman 1998). In addition, they are relevant to the kinds of impacts that are present in the St. Regis River drainage. They have been demonstrated to be more variable with anthropogenic disturbance than with natural environmental gradients (Bollman 1998). Each of the six metrics developed and tested for western Montana ecoregions is described below.

Table 1. Sampling sites and dates. Nineteen sites on eleven streams in the St.Regis River watershed. July-August 2001. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.

Site designation	Waterbody	Sampling Date	GPS Location	
			Lat.	Long.
StR1	St.Regis River	7/25/01	47° 26'37" N	115° 47'19"W
StR2 and StR2A	St.Regis River	7/25/01	47° 24'22" N	115° 29'30"W
StR3	St. Regis River	7/25/01	47° 20'35" N	115° 16'49"W
StR4	St. Regis River	8/2/01	47° 17'55" N	115° 14'04"W
Sil1	Silver Creek	7/23/01	47° 21'40" N	115° 33'58"W
Sil2	Silver Creek	7/23/01	47° 24'09" N	115° 30'56"W
Sav	Savenac Creek	8/3/01	47° 23'49" N	115° 23'38"W
Big1	Big Creek	8/1/01	47° 21'45" N	115° 25'42"W
Big2	Big Creek	8/1/01	47° 22'28" N	115° 23'37"W
Deer1	Deer Creek	7/24/01	47° 18'38" N	115° 24'17"W
Deer2	Deer Creek	7/24/01	47° 22'11" N	115° 21'39"W
FRock	Flat Rock Creek	7/24/01	47.3875° N	115.2457°W
12Mi	Twelvemile Creek	8/2/01	47° 22'21" N	115° 15'45"W
Ward1	Ward Creek	8/2/01	47° 17'11" N	115° 20'18"W
Ward2	Ward Creek	8/2/01	47° 18'42" N	115° 14'04"W
NFLJ1	North Fork Little Joe Creek	7/26/01	47° 13'11" N	115° 16'13"W
NFLJ2	North Fork Little Joe Creek	7/26/01	47° 16'12" N	115° 08'34"W
LJoe	Little Joe Creek	7/26/01	47° 17'33" N	115° 07'15"W

1. Ephemeroptera (mayfly) taxa richness. The number of mayfly taxa declines as water quality diminishes. Impairments to water quality which have been demonstrated to adversely affect the ability of mayflies to flourish include elevated water temperatures, heavy metal contamination, increased turbidity, low or high pH, elevated specific conductance and toxic chemicals. Few mayfly species are able to tolerate certain disturbances to instream habitat, such as excessive sediment deposition.

2. Plecoptera (stonefly) taxa richness. Stoneflies are particularly susceptible to impairments that affect a stream on a reach-level scale, such as loss of riparian canopy, streambank instability, channelization, and alteration of morphological features such as pool frequency and function, riffle development and sinuosity. Just as all benthic organisms, they are also susceptible to smaller scale habitat loss, such as by sediment deposition, loss of interstitial spaces between substrate particles, or unstable substrate.

3. Trichoptera (caddisfly) taxa richness. Caddisfly taxa richness has been shown to decline when sediment deposition affects their habitat. In addition, the presence of certain case-building caddisflies can indicate good retention of woody debris and lack of scouring flow conditions.

4. Number of sensitive taxa. Sensitive taxa are generally the first to disappear as anthropogenic disturbances increase. The list of sensitive taxa used here includes organisms sensitive to a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability, and others. Unimpaired streams of western Montana typically support at least four sensitive taxa (Bollman 1998).

5. Percent filter feeders. Filter-feeding organisms are a diverse group; they capture small particles of organic matter, or organically enriched sediment material, from the water column by means of a variety of adaptations, such as silken nets or hairy appendages. In forested montane streams, filterers are expected to occur in insignificant numbers. Their abundance increases when canopy cover is lost and when water temperatures increase and the accompanying growth of filamentous algae occurs. Some filtering organisms, specifically the Arctopsychid caddisflies (*Arctopsyche* spp. and *Parapsyche* sp.) build silken nets with large mesh sizes that capture small organisms such as chironomids and early-instar mayflies. Here they are considered predators, and, in this study, their abundance does not contribute to the percent filter feeders metric.

6. Percent tolerant taxa. Tolerant taxa are ubiquitous in stream sites, but when disturbance increases, their abundance increases proportionately. The list of taxa used here includes organisms tolerant of a wide range of disturbances, including warmer water temperatures, organic or nutrient pollution, toxic pollution, sediment deposition, substrate instability, and others.

Scoring criteria for each of the six metrics are presented in Table 2. Metrics differ in their possible value ranges as well as in the direction the values move as biological conditions change. For example, Ephemeroptera richness values may range from zero to ten taxa or higher. Larger values generally indicate favorable biotic conditions. On the

other hand, the percent filterers metric may range from 0% to 100%; in this case, larger values are negative indicators of biotic health. To facilitate scoring, therefore, metric values were transformed into a single scale. The range of each metric has been divided into four parts and assigned a point score between zero and three. A score of three indicates a metric value similar to one characteristic of a non-impaired condition. A score of zero indicates strong deviation from non-impaired condition and suggests severe degradation of biotic health. Scores for each metric were summed to give an overall score, the total bioassessment score, for each site in each sampling event. These scores were expressed as the percent of the maximum possible score, which is 18 for this metric battery.

Table 2. Metrics and scoring criteria for bioassessment of streams of western Montana ecoregions (Bollman 1998).

<i>metric</i>	<i>Score</i>			
	3	2	1	0
Ephemeroptera taxa richness	> 5	5 - 4	3 - 2	< 2
Plecoptera taxa richness	> 3	3 - 2	1	0
Trichoptera taxa richness	> 4	4 - 3	2	< 2
Sensitive taxa richness	> 3	3 - 2	1	0
Percent filterers	0 - 5	5.01 - 10	10.01 - 25	> 25
Percent tolerant taxa	0 - 5	5.01 - 10	10.01 - 35	> 35

The total bioassessment score for each site was expressed in terms of use-support. Criteria for use-support designations were developed by Montana DEQ and are presented in Table 3a. Scores were also translated into impairment classifications according to criteria outlined in Table 3a.

In this report, certain other metrics were used as descriptors of the benthic community response to habitat or water quality but were not incorporated into the bioassessment metric battery, either because they have not yet been tested for reliability in streams of western Montana, or because results of such testing did not show them to be robust at distinguishing impairment, or because they did not meet other requirements for inclusion in the metric battery. These metrics and their use in predicting the causes of impairment or in describing its effects on the biotic community are described below.

- The modified biotic index. This metric is an adaptation of the Hilsenhoff Biotic Index (HBI, Hilsenhoff 1987), which was originally designed to indicate organic enrichment of waters. Values of this metric are lowest in least impacted conditions. Taxa tolerant to saprobic conditions are also generally tolerant of warm water, fine sediment, and heavy filamentous algae growth (Bollman, unpublished data). Loss of canopy cover is often a contributor to higher biotic index values. The taxa values used in this report are modified to reflect habitat and water quality conditions in Montana (Bukantis 1998). Ordination studies of the benthic fauna of Montana's foothill prairie streams showed that there is a correlation between modified biotic index values and water temperature, substrate embeddedness, and fine sediment (Bollman 1998). In a study of reference

streams, the average value of the modified biotic index in least-impaired streams of western Montana was 2.5 (Wisseman 1992).

- Taxa richness. This metric is a simple count of the number of unique taxa present in a sample. Average taxa richness in samples from reference streams in western Montana was 28 (Wisseman 1992). Taxa richness is an expression of biodiversity, and generally decreases with degraded habitat or diminished water quality. However, taxa richness may show a paradoxical increase when mild nutrient enrichment occurs in previously oligotrophic waters, so this metric must be interpreted with caution.
- Percent predators. Aquatic invertebrate predators depend on a reliable source of invertebrate prey, and their abundance provides a measure of the trophic complexity supported by a site. Less disturbed sites have more plentiful habitat niches to support diverse prey species, which in turn support abundant predator species.
- Number of “clinger” taxa. So-called “clinger” taxa have physical adaptations that allow them to cling to smooth substrates in rapidly flowing water. Aquatic invertebrate “clingers” are sensitive to fine sediments that fill interstices between substrate particles and eliminate habitat complexity. Animals that occupy the hyporheic zones are included in this group of taxa. Expected “clinger” taxa richness in unimpaired streams of western Montana is at least 14 (Bollman, unpublished data).
- Number of long-lived taxa. Long-lived or semivoltine taxa require more than a year to completely develop, and their numbers decline when habitat and/or water quality conditions are unstable. They may completely disappear if channels are dewatered or if there are periodic water temperature elevations or other interruptions to their life cycles. Western Montana streams with stable habitat conditions are expected to support six or more long-lived taxa (Bollman, unpublished data).

Table 3a. Criteria for the assignment of use-support classifications / standards violation thresholds (Bukantis, 1997).

% Comparability to reference	Use support
>75	Full support--standards not violated
25-75	Partial support--moderate impairment--standards violated
<25	Non-support--severe impairment--standards violated

Table 3b. Criteria for the assignment of impairment classifications (Plafkin et al. 1989).

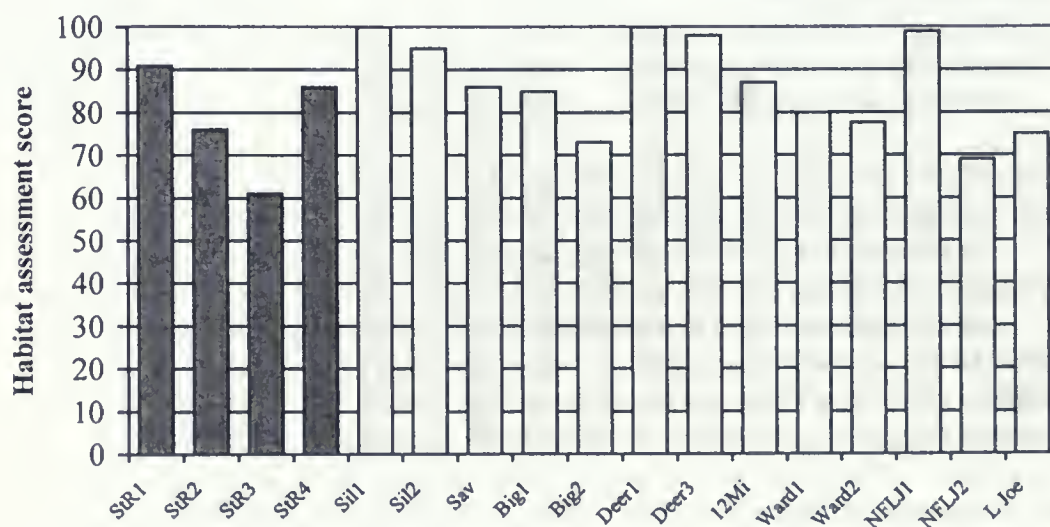
% Comparability to reference	Classification
> 83	nonimpaired
54-79	slightly impaired
21-50	moderately impaired
<17	severely impaired

RESULTS

Habitat assessment

Figure 1 compares habitat assessment results for the seventeen sites for which data was available. Tables 4 and 4a itemize the evaluated habitat parameters and shows the assigned scores for each.

Figure 1. Total habitat assessment scores for sites in the St. Regis River watershed, July-August 2001. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.



Generally good habitat conditions were reported for sites in the St. Regis River watershed; at eleven evaluated sites, conditions were perceived to be minimally altered by human activities. Optimal conditions were reported on the St. Regis River at the uppermost site (StR1) and the lowermost site (StR4). Extensive channel alteration noted at site StR2 was attributed partly to the proximity of both the interstate highway and the railroad cut. Streambank stability was reported to be compromised by these features. The combined impacts resulted in the perception of sub-optimal conditions at this site. At the other intermediate site on the St. Regis River, StR3, rip-rap and channelization combined with poor riparian zone width on one bank to produce overall conditions that appeared sub-optimal. Among the tributaries, Silver Creek received optimal scores for most parameters at both studied sites although riparian zone width was judged marginal on one bank at the lower site (Sil2). Among the tributaries for which habitat assessment was provided, Silver Creek appeared to have the least disturbed conditions.

On Savenac Creek the evaluated site (Sav) was perceived to have sub-optimal instream conditions, with benthic substrate particles tending to be dominated by non-cobble sizes and diminished riffle length. A diversion with a pump created some sediment deposition at or near the site. The uppermost site on Big Creek scored optimally for instream parameters, but streambank stability and vegetation were perceived to be sub-optimal. Still, scores suggest optimal habitat conditions overall. At the lower site, however, human disturbance was characterized as “heavy”, with man-made sediment bars notable. Moderate streambank stability was reported, but streambank vegetation was marginal or poor at the site, with evident disruption. Overall habitat conditions at the site were sub-optimal. Similarly, the upstream site on Deer Creek (Deer1) scored optimally, while the lower site (Deer2) appeared to have sub-optimal habitat conditions. The upper site lacked some benthic substrate diversity due to the prevalence of boulders and bedrock, but scored optimally in all other evaluated parameters. At the lower site, extensive downcutting was reported; braided channels and sediment deposition contributed to the sub-optimal conditions here. Moderately unstable streambanks were reported along one side of the channel.

No habitat information was provided for the site on Flat Rock Creek, however, the sample inventory suggests that the site was considered to be good enough to represent reference conditions, implying minimal human disturbance. At the single site studied on Twelve Mile Creek, scores suggest optimal habitat conditions, though some substrate embeddedness was reported. Some channel alteration was also noted; a man-made fish barrier was present at the site. Moderately unstable streambanks were assessed on one side of the channel, with active undercutting described. Both sites on Ward Creek scored optimally for habitat conditions, though both were reported to have somewhat diminished diversity of substrate particle sizes. Active undercutting and the presence of a bridge altered habitat conditions at the lower site on Ward Creek (Ward2), and mild sediment deposition was noted. While the upper site (Ward1) apparently had optimal streambank stability and vegetative cover, the lower site was judged to have moderately unstable banks and marginal vegetative protection.

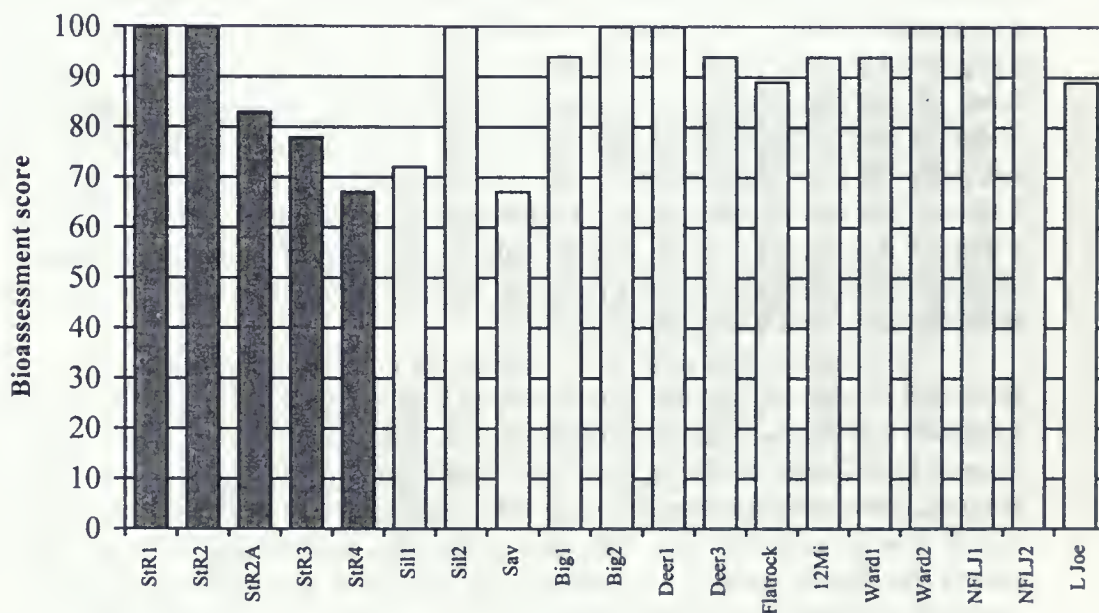
Minimal human disturbance and optimal habitat were perceived at the upper site on the North Fork of Little Joe Creek (NFLJ1). Field notes describe the site as “well aerated, unaltered pristine high mountain creek habitat.” At the lower site on the same creek (NFLJ2), however, conditions were judged sub-optimal. Riffle development was

assessed as less than ideal, some channel alteration, which was attributed to the proximity of a road, was noted, and moderately unstable streambanks were reported. Streambank vegetative protection was perceived to be poor on one side of the channel. The site on the mainstem of Little Joe Creek apparently had optimal instream conditions, but cobble bars were noted near the sampling site, and a marginal score was assigned to the sediment deposition parameter, though neither fine sediment nor embeddedness was noted. One streambank had extensive disruption of vegetative protection, although streambanks were reported to be moderately stable. Overall, habitat conditions at this site on Little Joe Creek scored sub-optimally.

Bioassessment

Figure 2 summarizes bioassessment scores for aquatic invertebrate communities at the nineteen sites in this study. Tables 5 and 5a itemize each contributing metric and show individual metric scores for each site. Tables 3a and 3b show criteria for impairment classifications and use-support categories recommended by Montana DEQ.

Figure 2. Total bioassessment scores for nineteen sites in the St. Regis River watershed, July – August 2001. Sites are described in Table 1. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.



Bioassessment scores derived by the method employed here suggest that fifteen of the nineteen sites studied achieve full support of designated uses and are essentially non-impaired. The graph illustrates a steady decrease in bioassessment scores for St. Regis River sites from upstream to downstream locations. Sites StR1, StR2, and StR2A fully support uses and are non-impaired. Site StR3 fully supports uses but exhibits slight impairment evident by fewer Plecoptera taxa than expected, fewer sensitive taxa than expected, and an elevated proportion of tolerant taxa. Farther downstream, site StR4 only partially supports designated uses and is slightly impaired. Impairment is exhibited in the

Table 4. Stream and riparian habitat assessment: Streams of the St.Regis River watershed. July-August 2001. No assessment was provided for Flat Rock Creek. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.

Max. possible score	Parameter	Site designation									
		StR1	StR2, 2A	StR3	StR4	Sil1	Sil2	Sav	Big1	Big2	
10	Riffle development	9	8	10	10	10	10	8	9	10	
10	Benthic substrate	9	9	7	10	10	8	7	10	10	
20	Embeddedness	19	17	18	18	20	20	16	18	18	
20	Channel alteration	17	10	9	16	20	20	15	17	6	
20	Sediment deposition	18	17	20	15	20	20	18	17	13	
20	Channel flow status	18	16	19	20	20	19	19	19	19	
20	Bank stability r / l	8 / 8	8 / 7	9 / 8	7 / 9	10 / 10	10 / 10	8 / 8	7 / 7	6 / 9	
20	Bank vegetation r / l	9.5 / 9.5	8 / 7	7 / 9	5 / 8	10 / 10	10 / 10	9 / 9	6 / 6	4 / 2	
20	Vegetated zone r / l	10 / 10	9 / 6	2 / 10	10 / 10	10 / 10	5 / 10	10 / 10	10 / 10	10 / 10	
160	Total	145	122	98	138	160	152	137	136	117	
	Percent of maximum	91	76	61	86	100	95	86	85	73	
	CONDITION*	OPT	SUB	SUB	OPT	OPT	OPT	OPT	OPT	SUB	

*Condition categories: Optimal (OPT) > 80% of maximum score; Sub-optimal (SUB) 75 - 56%; Marginal (MARG) 49 - 29%; Poor <23%. Adapted from Platkin et al. 1988.

Table 4a. Stream and riparian habitat assessment: Streams of the St.Regis River watershed. July-August 2001. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.

Max. possible score	Parameter	Site designation							
		Deer1	Deer3	12Mi	Ward1	Ward2	NFLJ1	NFLJ2	LJoe
10	Rifle development	9	8	10	10	10	10	8	10
10	Benthic substrate	8	9	10	8	8	10	10	10
20	Embeddedness	20	18	15	13	18	18	17	19
20	Channel alteration	20	10	18	19	19	20	11	17
20	Sediment deposition	20	12	18	19	13	20	19	6
20	Channel flow status	20	18	19	19	15	20	8	11
20	Bank stability r / l	10 / 10	6 / 5	4 / 9	10 / 10	6 / 5	10 / 10	5 / 5	8 / 8
20	Bank vegetation r / l	10 / 10	8 / 8	9 / 7	10 / 10	5 / 5	10 / 10	8 / 2	10 / 1
20	Vegetated zone r / l	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10	10 / 10	8 / 10	10 / 10
160	Total	157	122	139	128	124	158	111	120
	Percent of maximum	98	76	87	80	77.5	99	69	75
	CONDITION*	OPT	SUB	OPT	OPT	OPT	OPT	SUB	SUB

*Condition categories: Optimal (OPT) > 80% of maximum score; Sub-optimal (SUB) 75 - 56%; Marginal (MARG) 49 - 29%; Poor <23%. Adapted from Plafkin et al. 1988.

benthic community by fewer Plecoptera and Trichoptera taxa than expected, fewer sensitive taxa than expected, and an elevated proportion of filter-feeders.

Bioassessment scores for two tributary sites suggest partial use support and slight impairment. The upstream site on Silver Creek (Sil1) supported fewer Ephemeroptera taxa than expected, fewer sensitive taxa than expected, and elevated proportions of both generally tolerant taxa and filter-feeders. The single site studied on Savenac Creek yielded an assemblage with fewer Plecoptera and Trichoptera taxa than expected, fewer sensitive taxa than expected, and elevated proportions of both tolerant taxa and filter-feeders.

Aquatic invertebrate communities

Two sites on the most upstream tributary, Silver Creek, support contrasting benthic assemblages. Both have high taxa richness; 34 taxa were collected at the upper site (Sil1) and 35 at the lower site (Sil2). Both sites supported a rich predator fauna, with 8 taxa taken at each site. These findings suggest that a diversity of unimpaired habitats are available. However, the modified biotic index value calculated for the upper site was high (5.12) suggesting that water quality impairment may limit biotic potential at the site. This hypothesis is supported by the further observation that mayfly taxa richness was depressed at this site; only 5 taxa were collected, and two of these were relatively tolerant baetids: *Baetis tricaudatus* and *Dipheter hageni*. The occurrence of a third taxon, a few immature heptageniids, is, in all probability, a transient phenomenon. Conditions at the upper site appeared to support three sensitive taxa, and these were represented by early instars, once again suggesting the transience of these animals at the site. Water quality degradation is further suggested by the elevated relative abundance of tolerant taxa, which comprise 7% of the sampled assemblage. Moderately tolerant taxa comprised an even larger proportion; the dominant taxon collected was a fingernail clam in the family Sphaeriidae, which represented nearly 30% of all animals sampled. The nature of the water quality impairment is not readily apparent, but could include impacts from nutrient inputs, mild metal contamination, or other factors. Plentiful suspended organic material appears to be present, since 13% of organisms were filter-feeders. Both the diversity of caddisfly taxa (6 at the upper site and 7 at the lower) and the number of "clingers" (13 at the upper site and 20 at the lower) suggest that sediment deposition may affect biotic potential at the upper site somewhat more than at the lower site.

The single site visited on Savenac Creek yielded a community from which an elevated modified biotic index score (4.39) was calculated, suggesting impaired water quality. However, a robust and diverse mayfly assemblage contradicts the finding, and is probably the stronger evidence. The mayfly fauna includes the highly sensitive *Drunella doddsi*, and four other sensitive taxa were collected as well. Only 3 stonefly taxa were collected, including small numbers of the chloroperlid *Sweltsa* sp. and immature perlodids, which frequently drift. Low stonefly taxa richness is suggestive of disturbance on the reach scale, such as unstable streambanks, channel alteration, or riparian zone disruptions. Whether or not such impacts exist at Savenac Creek is not clear from the habitat assessment. Further, the sampled assemblage was characterized by low caddisfly taxa richness; only 4 taxa were collected, including single individuals of *Arctopsyche grandis* and *Rhyacophila alberta*. Low caddisfly taxa richness is suggestive of fine

Table 5. Metric values, scores, and bioassessments for sites in the St. Regis River watershed, July-August 2001. Sites are described in Table 1. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.

	SITES									
	StR1	StR2	StR2A	StR3	StR4	Si11	Si12	Sav	Big1	Big2
METRICS	METRIC VALUES									
Ephemeroptera richness	9	8	5	7	7	5	8	10	7	9
Plecoptera richness	4	5	2	2	2	5	4	3	3	5
Trichoptera richness	8	6	5	7	4	6	7	4	7	5
Number of sensitive taxa	6	6	4	3	3	3	6	4	4	6
Percent filterers	2	<1	<1	19	4	7	<1	6	1	1
Percent tolerant taxa	<1	0	0	1	26	12	<1	12	<1	1
	METRIC SCORES									
Ephemeroptera richness	3	3	2	3	3	2	3	3	3	3
Plecoptera richness	3	3	2	2	2	3	3	2	2	3
Trichoptera richness	3	3	3	3	2	3	3	2	3	3
Number of sensitive taxa	3	3	3	2	2	2	3	3	3	3
Percent filterers	3	3	3	1	3	2	3	2	3	3
Percent tolerant taxa	3	3	3	3	0	1	3	1	3	3
TOTAL SCORE (max.=18)	18	18	16	14	12	13	18	12	17	18
PERCENT OF MAX.	100	100	89	78	67	72	100	72	94	100
Impairment classification*	NON	NON	NON	SLI	SLI	SLI	NON	SLI	NON	NON
USE SUPPORT †	FULL	FULL	FULL	FULL	PART	PART	FULL	PART	FULL	FULL

* Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3a.

† Use support designations: See Table 3b.

Table 5a. Metric values, scores, and bioassessments for sites in the St. Regis River watershed, July-August 2001. Sites are described in Table 1. St. Regis River sites and tributary sites are listed separately, from upstream to downstream.

	SITES									
	Deer1	Deer2	Flatrock	12M	Ward1	Ward2	NFLJ1	NFLJ2	LJ2	
METRICS	METRIC VALUES									
Ephemeroptera richness	11	6	8	9	11	7	11	11	9	
Plecoptera richness	8	3	2	5	6	9	7	5	2	
Trichoptera richness	9	6	6	6	7	7	7	8	5	
Number of sensitive taxa	11	5	2	6	7	8	10	6	3	
Percent filterers	2	2	3	3	7	1	1	2	<1	
Percent tolerant taxa	<1	4	4	8	0	0	0	<1	0	
	METRIC SCORES									
Ephemeroptera richness	3	3	3	3	3	3	3	3	3	
Plecoptera richness	3	2	2	3	3	3	3	3	2	
Trichoptera richness	3	3	3	3	3	3	3	3	3	
Number of sensitive taxa	3	3	2	3	3	3	3	3	2	
Percent filterers	3	3	3	3	2	3	3	3	3	
Percent tolerant taxa	3	3	3	2	3	3	3	3	3	
TOTAL SCORE (max.=18)	18	17	16	17	17	18	18	18	16	
PERCENT OF MAX.	100	94	89	94	94	100	100	100	89	
Impairment classification*	NON	NON	NON	NON	NON	NON	NON	NON	NON	
USE SUPPORT †	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	FULL	

* Classifications: (NON) non-impaired, (SLI) slightly impaired, (MOD) moderately impaired, (SEV) severely impaired. See Table 3a.

† Use support designations: See Table 3b.

sediment deposition or other compromises of hard substrate surfaces, such as filamentous algae infestations. Again, such impacts are not clearly described in the habitat assessment. Twelve percent of the sampled assemblage consisted of filter-feeding organisms, including the blackfly *Simulium* sp., implying an abundance of fine organic particulates in suspension.

Both sites on Big Creek supported benthic assemblages characteristic of unimpaired montane streams. High taxa richness, high predator taxa richness and predator abundance suggest excellent habitat diversity. Low biotic index scores (1.83 at the upper site, 2.37 at the lower site) and robust and rich mayfly faunae imply good water quality. Dominant taxa at both sites are scrapers, which represent more than half of all organisms taken at both sites. This suggests that these sites are not extensively shaded. However, water temperature does not appear to be adversely affected; cold stenotherms are abundantly present at both sites. They include the mayfly *Drunella doddsi*, the stonefly *Doroneuria* sp., and the caddisfly in the Rhyacophila Iranda Group.

Excellent biotic health is suggested by assemblages collected at both sites on Deer Creek. Remarkable taxa richness (45) at the upper site (Deer1) includes representatives of all expected functional groups, including an abundance of shredders, suggesting adequate inputs of organic material from the riparian buffer. It also includes very sensitive taxa, such as the uncommon caddisfly *Sericostriata surdickae*, a pleasure to encounter in samples, since it suggests cold, clean water. The abundance of the turbellarian *Polycelis coronata* implies groundwater contributions to flow. At the lower site (Deer 2) low stonefly taxa richness may indicate subtle impairments due to reach-scale habitat disruptions.

The site on Flat Rock Creek is also characterized by low stonefly taxa richness as well as low stonefly abundance; a single individual of each of two taxa were collected. Otherwise, good water quality is suggested by the 8 mayfly taxa taken in the sample, and clean hard substrates are indicated by the presence of 21 "clinger" taxa, as well as by the presence of 6 caddisfly taxa.

The community represented by the sample taken at Twelve Mile Creek is characteristic of a cold, boulder-strewn, mountain stream. However, filter-feeders are somewhat more abundant than expected, suggesting that fine organic particulates are plentiful. A rich and diverse fauna, including 8 predator taxa, suggests that rich and diverse habitats are available. Three shredder taxa, including the midge *Brillia* sp. and the cold stenothermic stonefly *Zapada frigida*, were present, implying abundant contributions of organic material from the riparian sources. Groundwater influence is suggested by the abundance of *Polycelis coronata*.

Ward Creek also appears to support a diverse, balanced, functional benthic assemblage. At the upper site, the dominant taxon was the highly sensitive *Drunella doddsi*, which comprised nearly 9% of all sampled organisms. The presence of eleven predator taxa suggests rich habitats and plentiful niche space. Predator taxa richness was even greater at the lower Ward Creek site. At both Ward Creek locations, shredders represented an appreciable proportion of organisms, suggesting ample riparian energy inputs.

Both sampled sites on the North Fork of Little Joe Creek support assemblages consistent with near-pristine montane conditions. Sensitive cold-stenotherms, such as the stoneflies *Visoka cataractae*, *Dispaxia augusta*, and *Zapada columbiana*, were abundant,

and all functional components adequately represented. Downstream at the Little Joe Creek (LJ2) site stoneflies richness was poorer than expected, suggesting subtle habitat disruption on a reach scale. This hypothesis is supported by the further observation that only 2 sensitive taxa were present in the sample taken at this site.

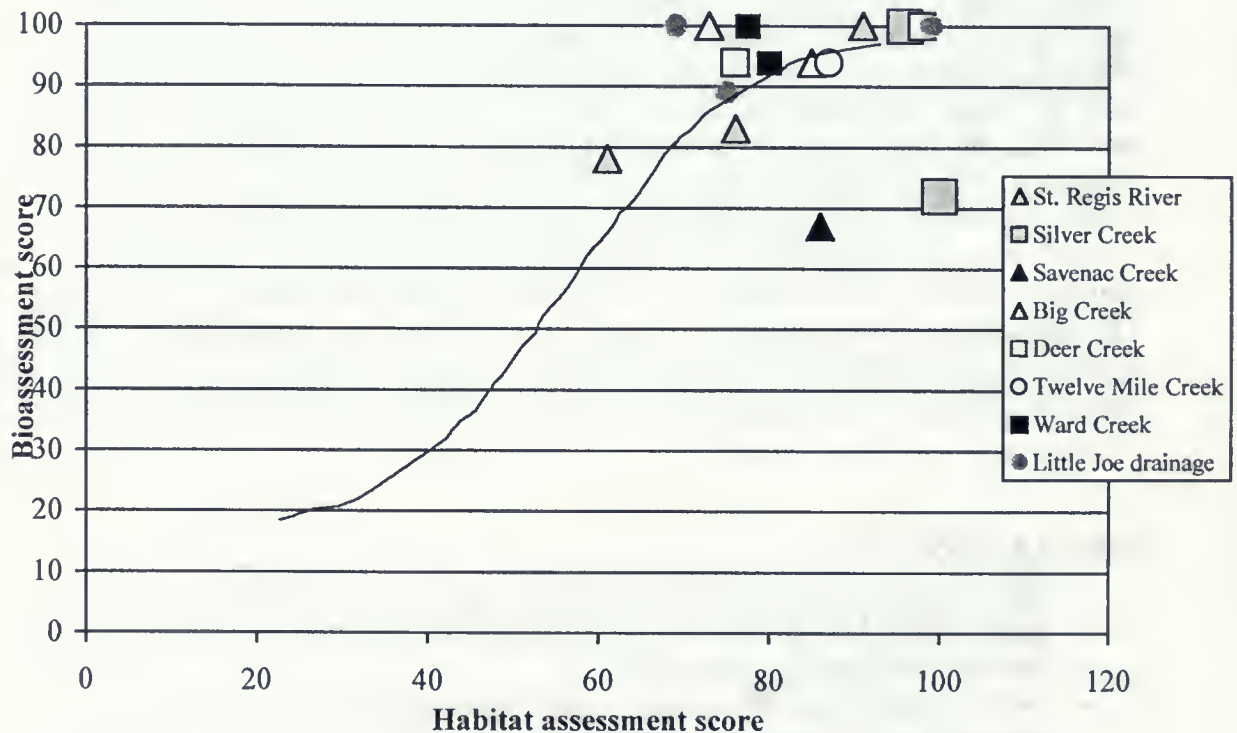
Bioassessment scores decrease from the uppermost site on the mainstem of the St. Regis River longitudinally to the lowermost site. Biotic health appears to be essentially unimpaired at sites StR1, StR2, and StR2A, although the benthic assemblage changes considerably within this reach. The number of predator taxa diminishes from 11 at the upstream site to 4 at the lowest site in this reach, and taxa richness also decreases from 41 taxa collected at StR1 to 27 at StR2A. These findings suggest that habitat has become more monotonous by the time the St. Regis River reaches the lower site. This may be due to sediment deposition or embeddedness, or loss of natural channel morphological features such as sinuosity or diverse instream flow combinations. In the downstream reach represented by samples from sites StR3 and StR4, taxa richness and predator taxa richness remain moderately low. "Clinger" taxa richness and the number of caddisfly taxa at these sites are also modestly diminished, suggesting that fine sediment deposition affects the composition of benthic assemblages at these sites. While mayfly taxa richness remained high at the lowest site, StR4, most of these taxa are represented by only a single individual; mild impairment of water quality may be indicated, though the nature of the impairment is unclear from the data available. The biotic index value (4.90) calculated for the assemblage collected at this site is elevated, suggesting that nutrient inputs or elevated water temperature may contribute to water quality impacts. The single cold-stenotherm present, the stonefly *Visoka cataractae*, was represented by a single animal. The appearance of the hemoglobin-bearing midge *Tribelos* sp. is disturbing, since it may suggest the occurrence of anoxic sediments in the reach; the suggestion must be qualified, however, by the fact that only a single organism in this taxon was taken in the sample.

CONCLUSIONS

- Water quality impairment may affect biotic potential at the upper site on Silver Creek (Sill). The nature of the impairment is unclear, but it may include nutrient inputs or mild metal contamination.
- Subtle habitat disruption appears to limit bioassessment scores at the site on Savenac Creek. These disruptions appear to include mild sediment deposition or embedded substrate; there is also some evidence of reach-scale disturbance, but its nature is unclear.
- Other tributary sites support benthic assemblages characteristic of montane streams with only minimal human disturbance.
- St. Regis River sites decline in biotic health from the most upstream site to the lowermost site. Evidence for increased sediment deposition along the longitudinal gradient sampled is present in the composition of benthic assemblages sampled in the river. Mild water quality degradation, perhaps by nutrients or warm temperatures, appears to contribute to slight impairment at the lowest site, StR4.
- The general dearth of shredders at most sites suggests a lack of riparian inputs of organic material, but is probably related more strongly to the sampling season.

- Figure 3 graphs the relationship between habitat assessment scores and bioassessment scores for sites sampled in this study. The red curve in the center of the graph represents the hypothetical relationship between habitat quality and biotic health when habitat degradation is the sole source of impairment to benthic assemblage health. (Barbour and Stribling 1991). Symbols which fall below the line indicate bioassessment scores much lower than the perceived habitat quality would be expected to support. This suggests that water quality perturbations or flow conditions impair biotic health in the presence of generally good habitat.

Figure 3. The relationship of habitat assessment scores and bioassessment scores for sites in the St. Regis River watershed. The red curve represents the hypothetical relationship between habitat scores and bioassessment scores if habitat quality solely determined biotic health.



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APPENDIX

Taxonomic data and summaries

The St. Regis River watershed

July-August, 2001

Aquatic Invertebrate Taxonomic Data

Site Name: St. Regis River

Site ID: St. Regis 1 7/25/01

Approx. percent of sample used: 77

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	2	0.61	4	CG
Nematoda	1	0.31	5	PA
<i>Nais</i>	1	0.31	8	CG
Tubificidae - immature	1	0.31	9	CG
Total Misc. Taxa	5	1.53		
<i>Baetis tricaudatus</i>	5	1.53	6	CG
<i>Drunella coloradensis</i>	1	0.31	0	CG
<i>Drunella doddsi</i>	1	0.31	0	CG
<i>Serratella tibialis</i>	7	2.14	2	CG
<i>Cinygmula</i> sp.	66	20.18	4	SC
<i>Epeorus albertae</i>	48	14.68	1	SC
<i>Epeorus longimanus</i>	17	5.20	1	SC
<i>Epeorus grandis</i>	3	0.92	0	SC
<i>Rhithrogena</i> sp.	4	1.22	0	SC
Total Ephemeroptera	152	46.48		
<i>Sweltsa</i> sp.	14	4.28	1	PR
<i>Visoka cataractae</i>	1	0.31	0	SH
<i>Zapada columbiana</i>	13	3.98	2	SH
<i>Megarcys</i> sp.	6	1.83	2	PR
Total Plecoptera	34	10.40		
<i>Parapsyche elsis</i>	1	0.31	1	PR
<i>Brachycentrus americanus</i>	1	0.31	1	OM
<i>Ochrotrichia</i> sp.	1	0.31	4	PH
<i>Dicosmoecus gilvipes</i>	1	0.31	2	SC
<i>Rhyacophila Betteni</i> Gr.	3	0.92	1	PR
<i>Rhyacophila Brunnea</i> Gr.	5	1.53	1	PR
<i>Rhyacophila Hyalinata</i> Gr.	1	0.31	1	PR
<i>Rhyacophila narvae</i>	1	0.31	1	PR
Total Trichoptera	14	4.28		
<i>Zaitzevia</i> sp.	1	0.31	4	CG
Total Coleoptera	1	0.31		
<i>Chelifera</i> sp.	1	0.31	6	PR
<i>Oreogeton</i> sp.	5	1.53	6	PR
<i>Simulium</i> sp.	1	0.31	6	CF
<i>Antocha</i> sp.	1	0.31	3	CG
<i>Dicranota</i> sp.	3	0.92	3	PR
<i>Hexatoma</i> sp.	2	0.61	2	PR
Total Diptera	13	3.98		
<i>Diamesa</i> sp.	2	0.61	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	2	0.61	4	OM
<i>Micropectra</i> sp.	87	26.61	7	CG
<i>Pagastia</i> sp.	2	0.61	1	CG
<i>Parametriocnemus</i> sp.	2	0.61	5	CG
<i>Polypedilum</i> sp.	3	0.92	6	OM
<i>Rheocricotopus</i> sp.	1	0.31	6	OM
<i>Thienemanniella</i> sp.	1	0.31	6	CG
<i>Tvetenia</i> sp.	8	2.45	5	CG
Total Chironomidae	108	33.03		
Grand Total	327	100.00		

Aquatic Invertebrate Summary Data

Site Name: St. Regis River

Site ID: St. Regis 1 7/25/01

TOTAL ABUNDANCE 327
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 200

TOTAL NUMBER OF TAXA 41
Number EPT taxa 21

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	5	1.53
Odonata	0	0	0.00
Ephemeroptera	9	152	46.48
Plecoptera	4	34	10.40
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	8	14	4.28
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.31
Diptera	6	13	3.98
Chironomidae	9	108	33.03

RATIOS OF TAX GROUP ABUNDANCES
EPT/Chironomidae 1.85

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	11	42	12.84
Parasite	1	1	0.31
Collector-gatherer	15	122	37.31
Collector-filterer	1	1	0.31
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	1	0.31
Scraper	6	139	42.51
Shredder	2	14	4.28
Xylophage	0	0	0.00
Omnivore	4	7	2.14
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 139.00
Scraper/(Scraper + C.filterer) 0.99
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	87	26.61
<i>Cinygmula</i> sp.	66	20.18
<i>Epeorus albertae</i>	48	14.68
<i>Epeorus longimanus</i>	17	5.20
<i>Sweltsa</i> sp.	14	4.28
SUBTOTAL 5 DOMINANTS	232	70.95
<i>Zapada columbiana</i>	13	3.98
<i>Tvetenia</i> sp.	8	2.45
<i>Serratella tibialis</i>	7	2.14
<i>Megarcys</i> sp.	6	1.83
<i>Baetis tricaudatus</i>	5	1.53
TOTAL DOMINANTS	271	82.87

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.80

DIVERSITY MEASURES

Shannon H (loge) 2.56
Shannon H (log2) 3.70
Evenness 0.69
Simpson D 0.15

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	89	27.06
Univoltine	230	70.34
Semivoltine	9	2.60

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	7	2.14
Intolerant	6	29	8.87
Clinger	20	172	52.60

Aquatic Invertebrate Taxonomic Data

Site Name: St. Regis River

Site ID: St. Regis 2 7-25-01

Approx. percent of sample used: 7

Taxon	Quantity	Percent	HBI	FFG
Enchytraeidae	6	2.03	4	CG
Acari	2	0.68	5	PA
Total Misc. Taxa	8	2.71		
<i>Diphetor hageni</i>	1	0.34	5	CG
<i>Drunella coloradensis</i>	2	0.68	0	CG
<i>Drunella doddsi</i>	2	0.68	0	CG
<i>Drunella grandis</i>	7	2.37	2	CG
<i>Drunella spinifera</i>	1	0.34	0	PR
<i>Serratella tibialis</i>	24	8.14	2	CG
<i>Cinygmula</i> sp.	2	0.68	4	SC
<i>Epeorus longimanus</i>	5	1.69	1	SC
Total Ephemeroptera	44	14.92		
<i>Sweltsa</i> sp.	2	0.68	1	PR
<i>Zapada cinctipes</i>	1	0.34	2	SH
<i>Zapada Oregonensis</i> Gr.	2	0.68	2	SH
<i>Skwala</i> sp.	1	0.34	2	PR
<i>Pteronarcys</i> sp. - early instars	1	0.34	0	OM
Total Plecoptera	7	2.37		
Arctopsychinae - early instars	1	0.34	2	PR
<i>Brachycentrus americanus</i>	7	2.37	1	OM
<i>Apatania</i> sp.	8	2.71	1	SC
<i>Ecclisomyia</i> sp.	1	0.34	2	OM
<i>Rhyacophila Angelita</i> Gr.	1	0.34	0	PR
<i>Rhyacophila Brunnea</i> Gr.	1	0.34	1	PR
Total Trichoptera	19	6.44		
<i>Heterlimnius</i> sp.	1	0.34	4	CG
<i>Lara avara</i>	1	0.34	4	SH
<i>Zaitzevia</i> sp.	1	0.34	4	CG
Total Coleoptera	3	1.02		
Ceratopogoninac	1	0.34	6	PR
<i>Clinocera</i> sp.	1	0.34	6	PR
<i>Glutops</i> sp.	1	0.34	3	PR
Total Diptera	3	1.02		
<i>Cricotopus (Isocladius)</i> Gr.	25	8.47	7	CG
<i>Diamesa</i> sp.	2	0.68	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	29	9.83	4	OM
<i>Eukiefferiella Devonica</i> Gr.	2	0.68	4	OM
<i>Micropsectra</i> sp.	79	26.78	7	CG
<i>Orthocladius</i> sp.	2	0.68	6	CG
<i>Pagastia</i> sp.	7	2.37	1	CG
<i>Polypedilum</i> sp.	4	1.36	6	OM
<i>Rheocricotopus</i> sp.	3	1.02	6	OM
<i>Thienemannimyia</i> Gr.	1	0.34	6	PR
<i>Tvetenia</i> sp.	57	19.32	5	CG
Total Chironomidae	211	71.53		
Grand Total	295	100.00		

Aquatic Invertebrate Summary Data

Site Name: St. Regis River

Site ID: St. Regis 2 7-25-01

TOTAL ABUNDANCE 295
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 70

TOTAL NUMBER OF TAXA 38
Number EPT taxa 19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	8	2.71
Odonata	0	0	0.00
Ephemeroptera	8	44	14.92
Plecoptera	5	7	2.37
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	19	6.44
Lepidoptera	0	0	0.00
Coleoptera	3	3	1.02
Diptera	3	3	1.02
Chironomidae	11	211	71.53

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.33

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	10	11	3.73
Parasite	1	2	0.68
Collector-gatherer	14	216	73.22
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	3	15	5.08
Shredder	3	4	1.36
Xylophage	0	0	0.00
Omnivore	7	47	15.93
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	79	26.78
<i>Tvetenia</i> sp.	57	19.32
<i>Eukiefferiella</i> Brehmi Gr.	29	9.83
<i>Cricotopus</i> (Isocladius) Gr.	25	8.47
<i>Serratella tibialis</i>	24	8.14
SUBTOTAL 5 DOMINANTS	214	72.54
<i>Apatania</i> sp.	8	2.71
<i>Drunella grandis</i>	7	2.37
<i>Brachycentrus americanus</i>	7	2.37
<i>Pagastia</i> sp.	7	2.37
Enchytraeidae	6	2.03
TOTAL DOMINANTS	249	84.41

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.69

DIVERSITY MEASURES

Shannon H (loge) 2.18
Shannon H (log2) 3.15
Evenness 0.60
Simpson D 0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	161	54.58
Univoltine	121	41.02
Semivoltine	13	4.41

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	1	0.34
Intolerant	3	10	3.39
Clinger	20	96	32.54

Aquatic Invertebrate Taxonomic Data

Site Name: St. Regis River

Site ID: St. Regis River 2A 7/25/01

Approx. percent of sample used: 4

Taxon	Quantity	Percent	HBI	FFG
Acari	2	0.69	5	PA
Total Misc. Taxa	2	0.69		
<i>Caudatella</i> sp.-early instar	2	0.69	1	CG
<i>Drunella grandis</i>	11	3.81	2	CG
<i>Serratella tibialis</i>	22	7.61	2	CG
<i>Cinygmula</i> sp.	1	0.35	4	SC
<i>Epeorus longimanus</i>	2	0.69	1	SC
Total Ephemeroptera	38	13.15		
<i>Suwallia</i> sp.	1	0.35	0	PR
<i>Zapada frigida</i>	3	1.04	2	SH
Total Plecoptera	4	1.38		
<i>Arctopsyche grandis</i>	3	1.04	1	PR
<i>Brachycentrus americanus</i>	5	1.73	1	OM
<i>Micrasema</i> sp.	3	1.04	1	MH
<i>Ecclisomyia</i> sp.	1	0.35	2	OM
<i>Rhyacophila Angelita</i> Gr.	1	0.35	0	PR
Total Trichoptera	13	4.50		
<i>Narpus</i> sp.	2	0.69	4	CG
<i>Optioservus</i> sp.	2	0.69	4	SC
Total Coleoptera	4	1.38		
<i>Antocha</i> sp.	1	0.35	3	CG
Total Diptera	1	0.35		
<i>Brillia</i> sp.	1	0.35	5	SH
<i>Diamesa</i> sp.	4	1.38	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	42	14.53	4	OM
<i>Eukiefferiella Devonica</i> Gr.	4	1.38	4	OM
<i>Micropsectra</i> sp.	89	30.80	7	CG
<i>Orthocladius</i> sp.	37	12.80	6	CG
<i>Pagastia</i> sp.	7	2.42	1	CG
<i>Polypedilum</i> sp.	3	1.04	6	OM
<i>Rheacricotopus</i> sp.	1	0.35	6	OM
<i>Thienemannimyia</i> Gr.	4	1.38	6	PR
<i>Tvetenia</i> sp.	35	12.11	5	CG
Total Chironomidae	227	78.55		
Grand Total	289	100.00		

Aquatic Invertebrate Summary Data

Site Name: St. Regis River

Site ID: St. Regis River 2A 7/25/01

TOTAL ABUNDANCE 289

Ephemeroptera + Plecoptera +

Trichoptera (EPT) abundance 55

TOTAL NUMBER OF TAXA 27

Number EPT taxa 12

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	2	0.69
Odonata	0	0	0.00
Ephemeroptera	5	38	13.15
Plecoptera	2	4	1.38
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	5	13	4.50
Lepidoptera	0	0	0.00
Coleoptera	2	4	1.38
Diptera	1	1	0.35
Chironomidae	11	227	78.55

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.24

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	4	9	3.11
Parasite	1	2	0.69
Collector-gatherer	10	210	72.66
Collector-filterer	0	0	0.00
Macrophyte-herbivore	1	3	1.04
Piercer-herbivore	0	0	0.00
Scraper	3	5	1.73
Shredder	2	4	1.38
Xylophage	0	0	0.00
Omnivore	6	56	19.38
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
 Scraper/(Scraper + C.filterer) 1.00
 Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	89	30.80
<i>Eukiefferiella</i> Brehmi Gr.	42	14.53
<i>Orthocladius</i> sp.	37	12.80
<i>Tvetenia</i> sp.	35	12.11
<i>Serratella tibialis</i>	22	7.61
SUBTOTAL 5 DOMINANTS	225	77.85
<i>Drunella grandis</i>	11	3.81
<i>Pagastia</i> sp.	7	2.42
<i>Brachycentrus americanus</i>	5	1.73
<i>Diamesa</i> sp.	4	1.38
<i>Eukiefferiella</i> Devonica Gr.	4	1.38
TOTAL DOMINANTS	256	88.57

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.87

DIVERSITY MEASURES

Shannon H (loge)	1.96
Shannon H (log2)	2.83
Evenness	0.59
Simpson D	0.13

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	172	59.60
Univoltine	104	36.07
Semivoltine	13	4.33

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	2	0.69
Intolerant	2	4	1.38
Clinger	14	59	20.42

Aquatic Invertebrate Taxonomic Data

Site Name: St. Regis River

Site ID: St. Regis 3

Approx. percent of sample used: 60

Taxon	Quantity	Percent	HBI	FFG
Acari	1	0.31	5	PA
Total Misc. Taxa	1	0.31		
<i>Baetis tricaudatus</i>	3	0.94	6	CG
<i>Dipheter hageni</i>	2	0.63	5	CG
<i>Drunella coloradensis</i>	1	0.31	0	CG
<i>Serratella tibialis</i>	12	3.75	2	CG
<i>Timpanoga hecuba</i>	5	1.56	7	CG
<i>Cinygmula</i> sp.	3	0.94	4	SC
<i>Ameletus</i> sp.	1	0.31	0	CG
Total Ephemeroptera	27	8.44		
<i>Hesperoperla pacifica</i>	5	1.56	2	PR
<i>Pteronarcys californica</i>	17	5.31	1	OM
Total Plecoptera	22	6.88		
<i>Brachycentrus americanus</i>	10	3.13	1	OM
<i>Micrasema</i> sp.	4	1.25	1	MH
<i>Agraylea</i> sp.	1	0.31	8	PH
<i>Ochrotrichia</i> sp.	44	13.75	4	PH
<i>Apatania</i> sp.	68	21.25	1	SC
<i>Rhyacophila Angelita</i> Gr.	1	0.31	0	PR
<i>Rhyacophila Betteni</i> Gr.	1	0.31	1	PR
Total Trichoptera	129	40.31		
<i>Cleptelmis addenda</i>	6	1.88	4	CG
<i>Optioservus</i> sp.	9	2.81	4	SC
Total Coleoptera	15	4.69		
<i>Atherix</i> sp.	9	2.81	4	PR
<i>Chelifera</i> sp.	3	0.94	6	PR
<i>Glutaps</i> sp.	2	0.63	3	PR
<i>Simulium</i> sp.	3	0.94	6	CF
<i>Antocha</i> sp.	4	1.25	3	CG
Total Diptera	21	6.56		
<i>Cricotopus nostococladius</i>	8	2.50	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	7	2.19	4	OM
<i>Eukiefferiella Devonica</i> Gr.	15	4.69	4	OM
<i>Micropsectra</i> sp.	4	1.25	7	CG
<i>Orthocladus</i> sp.	35	10.94	6	CG
<i>Pagastia</i> sp.	19	5.94	1	CG
<i>Polypedilum</i> sp.	2	0.63	6	OM
<i>Rheocricotopus</i> sp.	1	0.31	6	OM
<i>Tvetenia</i> sp.	14	4.38	5	CG
Total Chironomidae	105	32.81		
Grand Total	320	100.00		

Aquatic Invertebrate Summary Data

Site Name: St. Regis River

Site ID: St. Regis 3 7/25/01

TOTAL ABUNDANCE 320
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 178

TOTAL NUMBER OF TAXA 33
Number EPT taxa 16

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	1	0.31
Odonata	0	0	0.00
Ephemeroptera	7	27	8.44
Plecoptera	2	22	6.88
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	129	40.31
Lepidoptera	0	0	0.00
Coleoptera	2	15	4.69
Diptera	5	21	6.56
Chironomidae	9	105	32.81

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.70

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	6	21	6.56
Parasite	1	1	0.31
Collector-gatherer	12	106	33.13
Collector-filterer	1	3	0.94
Macrophyte-herbivore	1	4	1.25
Piercer-herbivore	3	53	16.56
Scraper	3	80	25.00
Shredder	0	0	0.00
Xylophage	0	0	0.00
Omnivore	6	52	16.25
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 26.67
Scraper/(Scraper + C.filterer) 0.96
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Apatania</i> sp.	68	21.25
<i>Ochrotrichia</i> sp.	44	13.75
<i>Orthocladus</i> sp.	35	10.94
<i>Pagastia</i> sp.	19	5.94
<i>Pteronarcys californica</i>	17	5.31
SUBTOTAL 5 DOMINANTS	183	57.19
<i>Eukiefferiella Devonica</i> Gr.	15	4.69
<i>Tvetenia</i> sp.	14	4.38
<i>Serratella tibialis</i>	12	3.75
<i>Brachycentrus americanus</i>	10	3.13
<i>Optioservus</i> sp.	9	2.81
TOTAL DOMINANTS	243	75.94

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.14

DIVERSITY MEASURES

Shannon H (loge) 2.46
Shannon H (log2) 3.55
Evenness 0.70
Simpson D 0.08

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	117	36.64
Univoltine	155	48.36
Semivoltine	48	15.00

	#TAXA	ABUNDANCE	PERCENT
Tolerant	4	62	19.38
Intolerant	3	78	24.38
Clinger	17	191	59.69

Aquatic Invertebrate Taxonomic Data

Site Name: St. Regis River

Site ID: St. Regis 04 8/2/01

Approx. percent of sample used: 7

Taxon	Quantity	Percent	HBI	FFG
<i>Nais variabilis</i>	17	5.65	8	CG
Tubificidae - immature	1	0.33	9	CG
Physidae	1	0.33	8	CG
Acari	7	2.33	5	PA
Total Misc. Taxa	26	8.64		
<i>Acentrella turbida</i>	2	0.66	4	CG
<i>Baetis tricaudatus</i>	1	0.33	6	CG
<i>Ephemerella inermis</i>	1	0.33	1	CG
<i>Serratella tibialis</i>	9	2.99	2	CG
<i>Cinygmula</i> sp.	1	0.33	4	SC
<i>Nixe</i> sp.	1	0.33	2	SC
<i>Paraleptophlebia</i> sp.	1	0.33	4	CG
Total Ephemeroptera	16	5.32		
<i>Visoka cataractae</i>	1	0.33	0	SH
<i>Pteronarcys</i> sp. - early instars	4	1.33	0	OM
Total Plecoptera	5	1.66		
Hydropsychidae - early instars	3	1.00	4	CF
<i>Ochrotrichia</i> sp.	1	0.33	4	PH
<i>Apatania</i> sp.	20	6.64	1	SC
<i>Rhyacophila Brunnea</i> Gr.	1	0.33	1	PR
Total Trichoptera	25	8.31		
<i>Heterlimnius</i> sp.	1	0.33	4	CG
<i>Optioservus</i> sp.	1	0.33	4	SC
<i>Zaitzevia</i> sp.	7	2.33	4	CG
Total Coleoptera	9	2.99		
<i>Simulium</i> sp.	1	0.33	6	CF
<i>Hexatoma</i> sp.	1	0.33	2	PR
Total Diptera	2	0.66		
<i>Cricotopus nostococladius</i>	1	0.33	3	PH
<i>Micropsectra</i> sp.	73	24.25	7	CG
<i>Pagastia</i> sp.	38	12.62	1	CG
<i>Polypedilum</i> sp.	1	0.33	6	OM
<i>Rheotanytarsus</i> sp.	73	24.25	6	CF
<i>Thienemanniella</i> sp.	1	0.33	6	CG
<i>Thienemannimyia</i> Gr.	5	1.66	6	PR
<i>Tribelos</i> sp.	1	0.33	6	UN
<i>Tvetenia</i> sp.	25	8.31	5	CG
Total Chironomidae	218	72.43		
Grand Total	301	100.00		

Aquatic Invertebrate Summary Data

Site Name: St. Regis River

Site ID: St. Regis 04 8/2/01

TOTAL ABUNDANCE 301
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 46

TOTAL NUMBER OF TAXA 31
Number EPT taxa 13

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	26	8.64
Odonata	0	0	0.00
Ephemeroptera	7	16	5.32
Plecoptera	2	5	1.66
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	4	25	8.31
Lepidoptera	0	0	0.00
Coleoptera	3	9	2.99
Diptera	2	2	0.66
Chironomidae	9	218	72.43

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.21

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	3	7	2.33
Parasite	1	7	2.33
Collector-gatherer	14	178	59.14
Collector-filterer	3	77	25.58
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	2	2	0.66
Scraper	4	23	7.64
Shredder	1	1	0.33
Xylophage	0	0	0.00
Omnivore	2	5	1.66
Unknown	1	1	0.33

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.30
Scraper/(Scraper + C.filterer) 0.23
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	73	24.25
<i>Rheotanytarsus</i> sp.	73	24.25
<i>Pagastia</i> sp.	38	12.62
<i>Tvetenia</i> sp.	25	8.31
<i>Apatania</i> sp.	20	6.64
SUBTOTAL 5 DOMINANTS	229	76.08
<i>Nais variabilis</i>	17	5.65
<i>Serratella tibialis</i>	9	2.99
Acari	7	2.33
<i>Zaitzevia</i> sp.	7	2.33
Thienemannimyia Gr.	5	1.66
TOTAL DOMINANTS	274	91.03

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.90

DIVERSITY MEASURES

Shannon H (loge) 1.96
Shannon H (log2) 2.83
Evenness 0.57
Simpson D 0.13

COMMUNITY VOLITINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	174	57.89
Univoltine	113	37.62
Semivoltine	14	4.49

	#TAXA	ABUNDANCE	PERCENT
Tolerant	5	11	3.65
Intolerant	3	22	7.31
Clinger	15	125	41.53

Aquatic Invertebrate Taxonomic Data

Site Name: Silver Creek

Site ID: Silver 01 7/23/01

Approx. percent of sample used: 37

Taxon	Quantity	Percent	HBI	FFG
<i>Hydra</i> sp.	2	0.63	5	PR
Tubificidae - immature	1	0.31	9	CG
<i>Eiseniella tetraedra</i>	5	1.57	8	CG
Sphaeriidae	93	29.25	8	CG
Acari	5	1.57	5	PA
Total Misc. Taxa	106	33.33		
<i>Baetis tricaudatus</i>	6	1.89	6	CG
<i>Dipheter hageni</i>	13	4.09	5	CG
<i>Caudatella</i> sp.-early instar	2	0.63	1	CG
Heptageniidae - early instar	4	1.26	4	SC
<i>Paraleptophlebia temporalis</i>	20	6.29	4	CG
Total Ephemeroptera	45	14.15		
<i>Sweltsa</i> sp.	8	2.52	1	PR
<i>Zapada cinctipes</i>	8	2.52	2	SH
<i>Zapada Oregonensis</i> Gr.	2	0.63	2	SH
<i>Isoperla</i> sp.	2	0.63	2	PR
<i>Pteronarcys</i> sp. - early instars	1	0.31	0	OM
Total Plecoptera	21	6.60		
<i>Micrasema</i> sp.	13	4.09	1	MH
<i>Lepidostoma</i> sp.-panel case larvae	2	0.63	1	SH
<i>Ecclisomyia</i> sp.	1	0.31	2	OM
<i>Polycentropus</i> sp.	1	0.31	6	PR
<i>Rhyacophila Brunnea</i> Gr.	21	6.60	1	PR
<i>Rhyacophila narvae</i>	2	0.63	1	PR
Total Trichoptera	40	12.58		
<i>Cleptelmis addenda</i>	8	2.52	4	CG
<i>Narpus</i> sp.	23	7.23	4	CG
<i>Zaitzevia</i> sp.	7	2.20	4	CG
Total Coleoptera	38	11.95		
Ceratopogoninae	1	0.31	6	PR
<i>Simulium</i> sp.	2	0.63	6	CF
<i>Rhabdomastix</i> sp.	1	0.31	3	UN
Total Diptera	4	1.26		
<i>Eukiefferiella Brehmi</i> Gr.	11	3.46	4	OM
<i>Orthocladius</i> sp.	3	0.94	6	CG
<i>Rheotanytarsus</i> sp.	37	11.64	6	CF
<i>Synorthocladius</i> sp.	3	0.94	2	CG
<i>Thienemanniella</i> sp.	1	0.31	6	CG
Thienemannimyia Gr.	8	2.52	6	PR
<i>Tvetenia</i> sp.	1	0.31	5	CG
Total Chironomidae	64	20.13		
Grand Total	318	100.00		

Aquatic Invertebrate Summary Data

Site Name: Silver Creek

Site ID: Silver 01 7/23/01

TOTAL ABUNDANCE 318
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 106

TOTAL NUMBER OF TAXA 34
Number EPT taxa 16

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	5	106	33.33
Odonata	0	0	0.00
Ephemeroptera	5	45	14.15
Plecoptera	5	21	6.60
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	40	12.58
Lepidoptera	0	0	0.00
Coleoptera	3	38	11.95
Diptera	3	4	1.26
Chironomidae	7	64	20.13

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.66

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	8	45	14.15
Parasite	1	5	1.57
Collector-gatherer	14	186	58.49
Collector-filterer	2	39	12.26
Macrophyte-herbivore	1	13	4.09
Piercer-herbivore	0	0	0.00
Scraper	1	4	1.26
Shredder	3	12	3.77
Xylophage	0	0	0.00
Omnivore	3	13	4.09
Unknown	1	1	0.31

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 0.10
Scraper/(Scraper + C.filterer) 0.09
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Sphaeriidae	93	29.25
<i>Rheotanytarsus</i> sp.	37	11.64
<i>Narpus</i> sp.	23	7.23
<i>Rhyacophila Brunnea</i> Gr.	21	6.60
<i>Paraleptophlebia temporalis</i>	20	6.29
SUBTOTAL 5 DOMINANTS	194	61.01
<i>Dipheter hageni</i>	13	4.09
<i>Micrasema</i> sp.	13	4.09
<i>Eukiefferiella Brehmi</i> Gr.	11	3.46
<i>Sweltsa</i> sp.	8	2.52
<i>Zapada cinctipes</i>	8	2.52
TOTAL DOMINANTS	247	77.67

SAPROBIC INDICES

Hilsenhoff Biotic Index 5.12

DIVERSITY MEASURES

Shannon H (loge) 2.34
Shannon H (log2) 3.38
Evenness 0.66
Simpson D 0.11

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	69	21.62
Univoltine	152	47.88
Semivoltine	97	30.50

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	21	6.60
Intolerant	2	2	0.63
Clinger	13	122	38.36

Aquatic Invertebrate Taxonomic Data

Site Name: Silver Creek

Site ID: Silver 02 7/23/01

Approx. percent of sample used: 60

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	5	1.52	4	CG
Enchytraeidae	5	1.52	4	CG
Acari	1	0.30	5	PA
Total Misc. Taxa	11	3.33		
<i>Baetis tricaudatus</i>	1	0.30	6	CG
<i>Drunella coloradensis</i>	3	0.91	0	CG
<i>Drunella doddsi</i>	1	0.30	0	CG
<i>Serratella tibialis</i>	22	6.67	2	CG
<i>Cinygmula</i> sp.	4	1.21	4	SC
<i>Epeorus albertae</i>	12	3.64	1	SC
<i>Epeorus longimanus</i>	4	1.21	1	SC
<i>Epeorus grandis</i>	2	0.61	0	SC
Total Ephemeroptera	49	14.85		
<i>Sweltsa</i> sp.	1	0.30	1	PR
<i>Zapada Oregonensis</i> Gr.	2	0.61	2	SH
<i>Kogotus</i> sp.	4	1.21	2	PR
<i>Megarcys</i> sp.	6	1.82	2	PR
Total Plecoptera	13	3.94		
<i>Arctopsyche grandis</i>	1	0.30	1	PR
<i>Brachycentrus americanus</i>	11	3.33	1	OM
<i>Ecclisomyia</i> sp.	2	0.61	2	OM
<i>Psychoglypha</i> sp.	4	1.21	0	OM
<i>Rhyacophila</i> -early instar	2	0.61	0	PR
<i>Rhyacophila Brunnea</i> Gr.	2	0.61	1	PR
<i>Rhyacophila narvae</i>	1	0.30	1	PR
<i>Neophylax occidentis</i>	1	0.30	1	SC
Total Trichoptera	24	7.27		
<i>Heterlimnius</i> sp.	7	2.12	4	CG
<i>Lara avara</i>	1	0.30	4	SH
Total Coleoptera	8	2.42		
<i>Simulium</i> sp.	2	0.61	6	CF
<i>Rhabdomastix</i> sp.	3	0.91	3	UN
Total Diptera	5	1.52		
<i>Eukiefferiella Brehmi</i> Gr.	158	47.88	4	OM
<i>Micropsectra</i> sp.	19	5.76	7	CG
<i>Orthocladius</i> sp.	4	1.21	6	CG
<i>Pagastia</i> sp.	26	7.88	1	CG
<i>Polypedilum</i> sp.	6	1.82	6	OM
<i>Rheocricotopus</i> sp.	1	0.30	6	OM
<i>Thienemanniella</i> sp.	1	0.30	6	CG
<i>Thienemannimyia</i> Gr.	3	0.91	6	PR
<i>Tvetenia</i> sp.	2	0.61	5	CG
Total Chironomidae	220	66.67		
Grand Total	330	100.00		

Aquatic Invertebrate Summary Data

Site Name: Silver Creek

Site ID: Silver 02 7/23/01

TOTAL ABUNDANCE	330
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	86
TOTAL NUMBER OF TAXA	36
Number EPT taxa	20

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	11	3.33
Odonata	0	0	0.00
Ephemeroptera	8	49	14.85
Plecoptera	4	13	3.94
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	8	24	7.27
Lepidoptera	0	0	0.00
Coleoptera	2	8	2.42
Diptera	2	5	1.52
Chironomidae	9	220	66.67

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.39
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	8	20	6.06
Parasite	1	1	0.30
Collector-gatherer	12	96	29.09
Collector-filterer	1	2	0.61
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	5	23	6.97
Shredder	2	3	0.91
Xylophage	0	0	0.00
Omnivore	6	182	55.15
Unknown	1	3	0.91

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	11.50
Scraper/(Scraper + C.filterer)	0.92
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Eukiefferiella Brehmi Gr.	158	47.88
Pagastia sp.	26	7.88
Serratella tibialis	22	6.67
Micropsectra sp.	19	5.76
Epeorus albertae	12	3.64
SUBTOTAL 5 DOMINANTS	237	71.82
Brachycentrus americanus	11	3.33
Heterlimnius sp.	7	2.12
Megarcys sp.	6	1.82
Polypedilum sp.	6	1.82
Polycelis coronata	5	1.52
TOTAL DOMINANTS	272	82.42

SAPROBIC INDICES

Hilsenhoff Biotic Index	3.38
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DIVERSITY MEASURES

Shannon H (loge)	1.92
Shannon H (log2)	2.76
Evenness	0.53
Simpson D	0.21

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	172	52.05
Univoltine	136	41.14
Semivoltine	23	6.82

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	1	0.30
Intolerant	6	18	5.45
Clinger	20	94	28.48

Aquatic Invertebrate Taxonomic Data

Site Name: Savenac Creek

Site ID: CO4SVNCC01 8/3/01

Approx. percent of sample used: 4

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	2	0.66	4	CG
Tubificidae - immature	3	0.99	9	CG
Acari	2	0.66	5	PA
Total Misc. Taxa	7	2.32		
<i>Acentrella turbida</i>	3	0.99	4	CG
<i>Baetis tricaudatus</i>	10	3.31	6	CG
<i>Diphetor hageni</i>	3	0.99	5	CG
<i>Caudatella</i> sp.-early instar	11	3.64	1	CG
<i>Drunella doddsi</i>	3	0.99	0	CG
<i>Drunella grandis</i>	4	1.32	2	CG
<i>Serratella tibialis</i>	7	2.32	2	CG
<i>Cinygmula</i> sp.	1	0.33	4	SC
<i>Epeorus longimanus</i>	5	1.66	1	SC
<i>Paraleptophlebia</i> sp.	3	0.99	4	CG
Total Ephemeroptera	50	16.56		
<i>Sweltsa</i> sp.	3	0.99	1	PR
<i>Zapada cinctipes</i>	10	3.31	2	SH
Perlodidae-early instar	4	1.32	2	PR
Total Plecoptera	17	5.63		
<i>Arctopsyche grandis</i>	1	0.33	1	PR
<i>Micrasema</i> sp.	6	1.99	1	MH
<i>Dolophilodes</i> sp.	4	1.32	2	CF
<i>Rhyacophila Alberta</i> Gr.	1	0.33	0	PR
Total Trichoptera	12	3.97		
<i>Cleptelmis addenda</i>	6	1.99	4	CG
<i>Heterlimnius</i> sp.	10	3.31	4	CG
<i>Optioservus</i> sp.	2	0.66	4	SC
Total Coleoptera	18	5.96		
Ceratopogoninae	4	1.32	6	PR
<i>Simulium</i> sp.	33	10.93	6	CF
<i>Antacha</i> sp.	1	0.33	3	CG
<i>Dicranota</i> sp.	2	0.66	3	PR
Total Diptera	40	13.25		
<i>Cricotopus Bicinctus</i> Gr.	3	0.99	7	CG
<i>Cricotopus nostococladius</i>	2	0.66	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	66	21.85	4	OM
<i>Eukiefferiella Devonica</i> Gr.	5	1.66	4	OM
<i>Micropsectra</i> sp.	36	11.92	7	CG
<i>Orthocladius</i> sp.	5	1.66	6	CG
<i>Pagastia</i> sp.	3	0.99	1	CG
<i>Rheocricotopus</i> sp.	2	0.66	6	OM
<i>Thienemanniella</i> sp.	3	0.99	6	CG
<i>Tvetenia</i> sp.	33	10.93	5	CG
Total Chironomidae	158	52.32		
Grand Total	302	100.00		

Aquatic Invertebrate Summary Data

Site Name: Savenac Creek

Site ID: CO4SVNCC01 8/3/01

TOTAL ABUNDANCE	302
Ephemeroptera + Plecoptera + Trichoptera (EPT) abundance	79
TOTAL NUMBER OF TAXA	37
Number EPT taxa	17

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	7	2.32
Odonata	0	0	0.00
Ephemeroptera	10	50	16.56
Plecoptera	3	17	5.63
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	4	12	3.97
Lepidoptera	0	0	0.00
Coleoptera	3	18	5.96
Diptera	4	40	13.25
Chironomidae	10	158	52.32

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.50
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	6	15	4.97
Parasite	1	2	0.66
Collector-gatherer	19	149	49.34
Collector-filterer	2	37	12.25
Macrophyte-herbivore	1	6	1.99
Piercer-herbivore	1	2	0.66
Scraper	3	8	2.65
Shredder	1	10	3.31
Xylophage	0	0	0.00
Omnivore	3	73	24.17
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.22
Scraper/(Scraper + C.filterer)	0.18
Shredder/Total organisms	0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Eukiefferiella Brehmi Gr.	66	21.85
Micropsectra sp.	36	11.92
Simulium sp.	33	10.93
Tvetenia sp.	33	10.93
Caudatella sp.-early instar	11	3.64
SUBTOTAL 5 DOMINANTS	179	59.27
Baetis tricaudatus	10	3.31
Zapada cinctipes	10	3.31
Heterlimnius sp.	10	3.31
Serratella tibialis	7	2.32
Micrasema sp.	6	1.99
TOTAL DOMINANTS	222	73.51

SAPROBIC INDICES

Hilsenhoff Biotic Index	4.39
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DIVERSITY MEASURES

Shannon H (loge)	2.53
Shannon H (log2)	3.65
Evenness	0.70
Simpson D	0.09

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	135	44.54
Univoltine	148	49.01
Semivoltine	20	6.46

	#TAXA	ABUNDANCE	PERCENT
Tolerant	3	18	5.96
Intolerant	3	7	2.32
Clinger	16	98	32.45

Aquatic Invertebrate Taxonomic Data

Site Name: Big Creek

Site ID: CO4BIGCR01 8/1/01

Approx. percent of sample used: 30

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	1	0.32	4	CG
Acari	1	0.32	5	PA
Total Misc. Taxa	2	0.64		
<i>Acentrella turbida</i>	9	2.88	4	CG
<i>Drunella coloradensis</i>	1	0.32	0	CG
<i>Drunella doddsi</i>	14	4.47	0	CG
<i>Drunella grandis</i>	2	0.64	2	CG
<i>Serratella tibialis</i>	15	4.79	2	CG
<i>Cinygmula</i> sp.	17	5.43	4	SC
<i>Epeorus</i> sp.-early instar	1	0.32	0	SC
<i>Epeorus longimanus</i>	7	2.24	1	SC
Total Ephemeroptera	66	21.09		
<i>Suwallia</i> sp.	11	3.51	0	PR
<i>Sweltsa</i> sp.	13	4.15	1	PR
<i>Kogotus</i> sp.	6	1.92	2	PR
Total Plecoptera	30	9.58		
<i>Brachycentrus americanus</i>	1	0.32	1	OM
<i>Lepidostoma</i> sp.-panel case larvae	1	0.32	1	SH
<i>Apatania</i> sp.	149	47.60	1	SC
<i>Rhyacophila Betteni</i> Gr.	8	2.56	1	PR
<i>Rhyacophila Brunnea</i> Gr.	1	0.32	1	PR
<i>Rhyacophila Iranda</i> Gr.	1	0.32	0	PR
<i>Rhyacophila narvae</i>	1	0.32	1	PR
Total Trichoptera	162	51.76		
<i>Heterlimnius</i> sp.	2	0.64	4	CG
<i>Optioservus</i> sp.	1	0.32	4	SC
<i>Zaitzevia</i> sp.	2	0.64	4	CG
Total Coleoptera	5	1.60		
<i>Glutops</i> sp.	1	0.32	3	PR
<i>Simulium</i> sp.	1	0.32	6	CF
<i>Antocha</i> sp.	1	0.32	3	CG
<i>Hexatoma</i> sp.	8	2.56	2	PR
Total Diptera	11	3.51		
<i>Corynoneura</i> sp.	1	0.32	7	CG
<i>Eukiefferiella Brehmi</i> Gr.	2	0.64	4	OM
<i>Micropsectra</i> sp.	11	3.51	7	CG
<i>Orthocladius</i> sp.	10	3.19	6	CG
<i>Pagastia</i> sp.	9	2.88	1	CG
<i>Rheocricotopus</i> sp.	2	0.64	6	OM
<i>Thienemannimyia</i> Gr.	1	0.32	6	PR
<i>Tvetenia</i> sp.	1	0.32	5	CG
Total Chironomidae	37	11.82		
Grand Total	313	100.00		

Aquatic Invertebrate Summary Data

Site Name: Big Creek

Site ID: C04BIGCR01 8/1/01

TOTAL ABUNDANCE 313
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 258

TOTAL NUMBER OF TAXA 35
Number EPT taxa 18

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	2	0.64
Odonata	0	0	0.00
Ephemeroptera	8	66	21.09
Plecoptera	3	30	9.58
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	162	51.76
Lepidoptera	0	0	0.00
Coleoptera	3	5	1.60
Diptera	4	11	3.51
Chironomidae	8	37	11.82

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 6.97

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	10	51	16.29
Parasite	1	1	0.32
Collector-gatherer	14	79	25.24
Collector-filterer	1	1	0.32
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	5	175	55.91
Shredder	1	1	0.32
Xylophage	0	0	0.00
Omnivore	3	5	1.60
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 175.00
Scraper/(Scraper + C.filterer) 0.99
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Apatania</i> sp.	149	47.60
<i>Cinygmula</i> sp.	17	5.43
<i>Serratella tibialis</i>	15	4.79
<i>Drunella doddsi</i>	14	4.47
<i>Sweltsa</i> sp.	13	4.15
SUBTOTAL 5 DOMINANTS	208	66.45
<i>Suwallia</i> sp.	11	3.51
<i>Micropsectra</i> sp.	11	3.51
<i>Orthocladius</i> sp.	10	3.19
<i>Acentrella turbida</i>	9	2.88
<i>Pagastia</i> sp.	9	2.88
TOTAL DOMINANTS	258	82.43

SAPROBIC INDICES

Hilsenhoff Biotic Index 1.83

DIVERSITY MEASURES

Shannon H (loge) 1.92
Shannon H (log2) 2.77
Evenness 0.54
Simpson D 0.20

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	37	11.66
Univoltine	265	84.66
Semivoltine	12	3.67

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	3	0.96
Intolerant	4	157	50.16
Clinger	19	231	73.80

Aquatic Invertebrate Taxonomic Data

Site Name: Big Creek

Site ID: CO4BIGCR02 8/1/01

Approx. percent of sample used: 47

Taxon	Quantity	Percent	HBI	FFG
Acari	1	0.30	5	PA
Total Misc. Taxa	1	0.30		
<i>Acentrella turbida</i>	1	0.30	4	CG
<i>Baetis tricaudatus</i>	3	0.90	6	CG
<i>Drunella coloradensis</i>	11	3.28	0	CG
<i>Drunella doddsi</i>	7	2.09	0	CG
<i>Serratella tibialis</i>	52	15.52	2	CG
<i>Cinygmula</i> sp.	59	17.61	4	SC
<i>Epeorus albertae</i>	1	0.30	1	SC
<i>Epeorus longimanus</i>	84	25.07	1	SC
<i>Rhithrogena</i> sp.	2	0.60	0	SC
Total Ephemeroptera	220	65.67		
<i>Suwallia</i> sp.	3	0.90	0	PR
<i>Sweltsa</i> sp.	3	0.90	1	PR
<i>Doroneuria</i> sp.	1	0.30	1	PR
<i>Kogotus</i> sp.	2	0.60	2	PR
<i>Megarcys</i> sp.	3	0.90	2	PR
Total Plecoptera	12	3.58		
<i>Arctopsyche grandis</i>	2	0.60	1	PR
<i>Brachycentrus americanus</i>	3	0.90	1	OM
<i>Apatania</i> sp.	30	8.96	1	SC
<i>Rhyacophila Angelita</i> Gr.	1	0.30	0	PR
<i>Rhyacophila Betteni</i> Gr.	2	0.60	1	PR
Total Trichoptera	38	11.34		
<i>Heterolimnius</i> sp.	11	3.28	4	CG
Total Coleoptera	11	3.28		
<i>Glutops</i> sp.	1	0.30	3	PR
<i>Simulium</i> sp.	4	1.19	6	CF
<i>Hexatoma</i> sp.	11	3.28	2	PR
Total Diptera	16	4.78		
<i>Cricotopus nostococladius</i>	1	0.30	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	1	0.30	4	OM
<i>Micropsectra</i> sp.	15	4.48	7	CG
<i>Pagastia</i> sp.	4	1.19	1	CG
<i>Polypedilum</i> sp.	1	0.30	6	OM
<i>Rheocricotopus</i> sp.	3	0.90	6	OM
<i>Synorthocladius</i> sp.	1	0.30	2	CG
<i>Thienemannimyia</i> Gr.	2	0.60	6	PR
<i>Tvetenia</i> sp.	9	2.69	5	CG
Total Chironomidae	37	11.04		
Grand Total	335	100.00		

Aquatic Invertebrate Summary Data

Site Name: Big Creek

Site ID: CO4BIGCR02 8/1/01

TOTAL ABUNDANCE 335
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 270

TOTAL NUMBER OF TAXA 33
Number EPT taxa 19

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	1	0.30
Odonata	0	0	0.00
Ephemeroptera	9	220	65.67
Plecoptera	5	12	3.58
Hemiptera	0	0	0.00
Megalopectera	0	0	0.00
Trichoptera	5	38	11.34
Lepidoptera	0	0	0.00
Coleoptera	1	11	3.28
Diptera	3	16	4.78
Chironomidae	9	37	11.04

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 7.30

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	11	31	9.25
Parasite	1	1	0.30
Collector-gatherer	10	114	34.03
Collector-filterer	1	4	1.19
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	1	0.30
Scraper	5	176	52.54
Shredder	0	0	0.00
Xylophage	0	0	0.00
Omnivore	4	8	2.39
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 44.00
Scraper/(Scraper + C.filterer) 0.98
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Epeorus longimanus</i>	84	25.07
<i>Cinygmula</i> sp.	59	17.61
<i>Serratella tibialis</i>	52	15.52
<i>Apatania</i> sp.	30	8.96
<i>Micropsectra</i> sp.	15	4.48
SUBTOTAL 5 DOMINANTS	240	71.64
<i>Drunella coloradensis</i>	11	3.28
<i>Heterlimnius</i> sp.	11	3.28
<i>Hexatoma</i> sp.	11	3.28
<i>Tvetenia</i> sp.	9	2.69
<i>Drunella doddsi</i>	7	2.09
TOTAL DOMINANTS	289	86.27

SAPROBIC INDICES

Hilsenhoff Biotic Index 2.37

DIVERSITY MEASURES

Shannon H (loge) 2.14
Shannon H (log2) 3.08
Evenness 0.61
Simpson D 0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	32	9.48
Univoltine	285	85.00
Semivoltine	19	5.52

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	3	0.90
Intolerant	6	38	11.34
Clinger	17	275	82.09

Aquatic Invertebrate Taxonomic Data

Site Name: Deer Creek

Site ID: Deer Creek 01 7/24/01

Approx. percent of sample used: 33

Taxon	Quantity	Percent	HB1	FFG
<i>Polycelis coronata</i>	32	10.26	4	CG
Tubificidae - immature	7	2.24	9	CG
Hydrobiidae	1	0.32	8	SC
Ostracoda	1	0.32	8	CG
Total Misc. Taxa	41	13.14		
<i>Baetis tricaudatus</i>	6	1.92	6	CG
<i>Caudatella</i> sp.-early instar	3	0.96	1	CG
<i>Drunella coloradensis</i>	1	0.32	0	CG
<i>Drunella doddsi</i>	4	1.28	0	CG
<i>Serratella tibialis</i>	12	3.85	2	CG
<i>Cinygmula</i> sp.	5	1.60	4	SC
<i>Epeorus albertae</i>	9	2.88	1	SC
<i>Epeorus grandis</i>	8	2.56	0	SC
<i>Rhithrogena</i> sp.	12	3.85	0	SC
<i>Paraleptophlebia temporalis</i>	6	1.92	4	CG
<i>Ameletus</i> sp.	1	0.32	0	CG
Total Ephemeroptera	67	21.47		
<i>Sweltsa</i> sp.	2	0.64	1	PR
<i>Despaxia augusta</i>	3	0.96	0	SH
<i>Visoka cataractae</i>	2	0.64	0	SH
<i>Zapada columbiana</i>	17	5.45	2	SH
<i>Doroneuria</i> sp.	1	0.32	1	PR
<i>Isoperla</i> sp.	1	0.32	2	PR
<i>Megarcys</i> sp.	7	2.24	2	PR
<i>Yoraperla</i> sp.	24	7.69	1	SH
Total Plecoptera	57	18.27		
<i>Parapsyche elsis</i>	5	1.60	1	PR
<i>Micrasema</i> sp.	5	1.60	1	MH
<i>Rhyacophila Betteni</i> Gr.	2	0.64	1	PR
<i>Rhyacophila blarina</i>	3	0.96	1	PR
<i>Rhyacophila Brunnea</i> Gr.	2	0.64	1	PR
<i>Rhyacophila Hyalinata</i> Gr.	1	0.32	1	PR
<i>Rhyacophila narvae</i>	1	0.32	1	PR
<i>Neothremma</i> sp.	4	1.28	0	SC
<i>Sericostriata surdickae</i>	7	2.24	0	SC
Total Trichoptera	30	9.62		
<i>Heterlimnius</i> sp.	1	0.32	4	CG
Total Coleoptera	1	0.32		
<i>Prosimulium</i> sp.	1	0.32	3	CF
<i>Simulium</i> sp.	1	0.32	6	CF
Total Diptera	2	0.64		
<i>Cricotopus nostococladus</i>	2	0.64	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	10	3.21	4	OM
<i>Eukiefferiella Devonica</i> Gr.	1	0.32	4	OM
<i>Micropsectra</i> sp.	75	24.04	7	CG
<i>Pagastia</i> sp.	13	4.17	1	CG
<i>Parametriocnemus</i> sp.	1	0.32	5	CG
<i>Rheocricotopus</i> sp.	4	1.28	6	OM
<i>Thienemanniella</i> sp.	2	0.64	6	CG
<i>Thienemannimyia</i> Gr.	1	0.32	6	PR
<i>Tvetenia</i> sp.	5	1.60	5	CG
Total Chironomidae	114	36.54		
Grand Total	312	100.00		

Aquatic Invertebrate Summary Data

Site Name: Deer Creek

Site ID: Deer Creek 01 7/24/01

TOTAL ABUNDANCE 312
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 154

TOTAL NUMBER OF TAXA 45
Number EPT taxa 28

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	41	13.14
Odonata	0	0	0.00
Ephemeroptera	11	67	21.47
Plecoptera	8	57	18.27
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	9	30	9.62
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.32
Diptera	2	2	0.64
Chironomidae	10	114	36.54

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.35

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	11	26	8.33
Parasite	0	0	0.00
Collector-gatherer	16	170	54.49
Collector-filterer	2	2	0.64
Macrophyte-herbivore	1	5	1.60
Piercer-herbivore	1	2	0.64
Scraper	7	46	14.74
Shredder	4	46	14.74
Xylophage	0	0	0.00
Omnivore	3	15	4.81
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 23.00
Scraper/(Scraper + C.filterer) 0.96
Shredder/Total organisms 0.05

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	75	24.04
<i>Polycelis coronata</i>	32	10.26
<i>Yoraperla</i> sp.	24	7.69
<i>Zapada columbiana</i>	17	5.45
<i>Pagastia</i> sp.	13	4.17
SUBTOTAL 5 DOMINANTS	161	51.60
<i>Serratella tibialis</i>	12	3.85
<i>Rhithrogena</i> sp.	12	3.85
<i>Eukiefferiella Brehmi</i> Gr.	10	3.21
<i>Epeorus albertae</i>	9	2.88
<i>Epeorus grandis</i>	8	2.56
TOTAL DOMINANTS	212	67.95

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.42

DIVERSITY MEASURES

Shannon H (loge) 3.11
Shannon H (log2) 4.48
Evenness 0.82
Simpson D 0.10

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	123	39.42
Univoltine	171	54.65
Semivoltine	19	5.93

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	6	1.92
Intolerant	11	80	25.64
Clinger	20	107	34.29

Aquatic Invertebrate Taxonomic Data

Site Name: Deer Creek

Site ID: Deer Creek 3 7/24/01

Approx. percent of sample used: 9

Taxon	Quantity	Percent	HBI	FFG
<i>Baetis tricaudatus</i>	7	2.00	6	CG
<i>Caudatella</i> sp.-early instar	8	2.29	1	CG
<i>Drunella coloradensis</i>	1	0.29	0	CG
<i>Serratella tibialis</i>	19	5.43	2	CG
<i>Cinygmula</i> sp.	1	0.29	4	SC
<i>Epeorus longimanus</i>	1	0.29	1	SC
Total Ephemeroptera	37	10.57		
<i>Sweltsa</i> sp.	1	0.29	1	PR
<i>Zapada columbiana</i>	23	6.57	2	SH
<i>Kogotus</i> sp.	1	0.29	2	PR
Total Plecoptera	25	7.14		
<i>Arctopsyche grandis</i>	1	0.29	1	PR
<i>Parapsyche elsis</i>	1	0.29	1	PR
<i>Brachycentrus americanus</i>	8	2.29	1	OM
<i>Micrasema</i> sp.	4	1.14	1	MH
<i>Dolophilodes</i> sp.	1	0.29	2	CF
<i>Rhyacophila Brunnea</i> Gr.	2	0.57	1	PR
Total Trichoptera	17	4.86		
<i>Heterlimnius</i> sp.	1	0.29	4	CG
Total Coleoptera	1	0.29		
<i>Clinocera</i> sp.	2	0.57	6	PR
<i>Simulium</i> sp.	13	3.71	6	CF
Total Diptera	15	4.29		
<i>Cricotopus nostococladius</i>	10	2.86	3	PH
<i>Eukiefferiella Brehmi</i> Gr.	129	36.86	4	OM
<i>Eukiefferiella Devonica</i> Gr.	22	6.29	4	OM
<i>Micropsectra</i> sp.	12	3.43	7	CG
<i>Orthocladius</i> sp.	26	7.43	6	CG
<i>Pagastia</i> sp.	7	2.00	1	CG
<i>Parametriocnemus</i> sp.	1	0.29	5	CG
<i>Polypedilum</i> sp.	18	5.14	6	OM
<i>Rheocricotopus</i> sp.	3	0.86	6	OM
<i>Thienemanniella</i> sp.	1	0.29	6	CG
<i>Thienemannimyia</i> Gr.	1	0.29	6	PR
<i>Tvetenia</i> sp.	25	7.14	5	CG
Total Chironomidae	255	72.86		
Grand Total	350	100.00		

Aquatic Invertebrate Summary Data

Site Name: Deer Creek

Site ID: Deer Creek 3 7/24/01

TOTAL ABUNDANCE	350
Ephemeroptera + Plecoptera +	
Trichoptera (EPT) abundance	79
TOTAL NUMBER OF TAXA	30
Number EPT taxa	15

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Misc. Taxa	0	0	0.00
Odonata	0	0	0.00
Ephemeroptera	6	37	10.57
Plecoptera	3	25	7.14
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	17	4.86
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.29
Diptera	2	15	4.29
Chironomidae	12	255	72.86

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.31
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDAN	PERCENT
Predator	7	9	2.57
Parasite	0	0	0.00
Collector-gatherer	11	108	30.86
Collector-filterer	2	14	4.00
Macrophyte-herbivore	1	4	1.14
Piercer-herbivore	1	10	2.86
Scraper	2	2	0.57
Shredder	1	23	6.57
Xylophage	0	0	0.00
Omnivore	5	180	51.43
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	0.14
Scraper/(Scraper + C.filterer)	0.13
Shredder/Total organisms	0.02

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Eukiefferiella Brehmi Gr.	129	36.86
Orthocladius sp.	26	7.43
Tvetenia sp.	25	7.14
Zapada columbiana	23	6.57
Eukiefferiella Devonica Gr.	22	6.29
SUBTOTAL 5 DOMINANTS	225	64.29
Serratella tibialis	19	5.43
Polypedilum sp.	18	5.14
Simulium sp.	13	3.71
Micropsectra sp.	12	3.43
Caudatella sp.	8	2.29
TOTAL DOMINANTS	295	84.29

SAPROBIC INDICES

Hilsenhoff Biotic Index	4.01
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DIVERSITY MEASURES

Shannon H (loge)	2.43
Shannon H (log2)	3.51
Evenness	0.72
Simpson D	0.16

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	197	56.14
Univoltine	142	40.43
Semivoltine	12	3.43

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	7	2.00
Intolerant	5	36	10.29
Clinger	16	82	23.43

Aquatic Invertebrate Taxonomic Data

Site Name: Flatrock Creek

Site ID: Flatrock 1 7/24/01

Approx. percent of sample used: 20

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	9	2.98	4	CG
Tubificidae - immature	7	2.32	9	CG
<i>Eiseniella tetraedra</i>	1	0.33	8	CG
<i>Eclipidrilus</i> sp.	1	0.33	8	CG
Sphaeriidae	2	0.66	8	CG
Total Misc. Taxa	20	6.62		
<i>Baetis tricaudatus</i>	2	0.66	6	CG
<i>Caudatella</i> sp.-early instar	32	10.60	1	CG
<i>Drunella coloradensis</i>	10	3.31	0	CG
<i>Drunella doddsi</i>	3	0.99	0	CG
<i>Serratella tibialis</i>	12	3.97	2	CG
<i>Cinygmula</i> sp.	8	2.65	4	SC
<i>Epeorus</i> sp.-early instar	4	1.32	0	SC
<i>Epeorus longimanus</i>	1	0.33	1	SC
<i>Rhithrogena</i> sp.	1	0.33	0	SC
Total Ephemeroptera	73	24.17		
<i>Amphinemura</i> sp.	1	0.33	2	SH
<i>Kogotus</i> sp.	1	0.33	2	PR
Total Plecoptera	2	0.66		
<i>Brachycentrus americanus</i>	8	2.65	1	OM
<i>Micrasema</i> sp.	10	3.31	1	MH
<i>Glossosoma</i> sp.	2	0.66	1	SC
<i>Dolophilodes</i> sp.	2	0.66	2	CF
<i>Rhyacophila Brunnea</i> Gr.	2	0.66	1	PR
<i>Rhyacophila narvae</i>	2	0.66	1	PR
Total Trichoptera	26	8.61		
<i>Cleptelmis addenda</i>	8	2.65	4	CG
<i>Heterlimnius</i> sp.	30	9.93	4	CG
Total Coleoptera	38	12.58		
<i>Chelifera</i> sp.	1	0.33	6	PR
<i>Prosimulium</i> sp.	1	0.33	3	CF
<i>Simulium</i> sp.	1	0.33	6	CF
Total Diptera	3	0.99		
<i>Eukiefferiella Brehmi</i> Gr.	96	31.79	4	OM
<i>Eukiefferiella Devonica</i> Gr.	19	6.29	4	OM
<i>Orthocladius</i> sp.	4	1.32	6	CG
<i>Pagastia</i> sp.	6	1.99	1	CG
<i>Polypedilum</i> sp.	1	0.33	6	OM
<i>Rheocricotopus</i> sp.	2	0.66	6	OM
<i>Rheotanytarsus</i> sp.	7	2.32	6	CF
<i>Thienemanniella</i> sp.	3	0.99	6	CG
<i>Tvetenia</i> sp.	2	0.66	5	CG
Total Chironomidae	140	46.36		
Grand Total	302	100.00		

Aquatic Invertebrate Summary Data

Site Name: Flatrock Creek

Site ID: Flatrock 1 7/24/01

TOTAL ABUNDANCE	302
Ephemeroptera + Plecoptera +	
Trichoptera (EPT) abundance	101
TOTAL NUMBER OF TAXA	36
Number EPT taxa	17

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	5	20	6.62
Odonata	0	0	0.00
Ephemeroptera	9	73	24.17
Plecoptera	2	2	0.66
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	26	8.61
Lepidoptera	0	0	0.00
Coleoptera	2	38	12.58
Diptera	3	3	0.99
Chironomidae	9	140	46.36

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae	0.72
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FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	4	6	1.99
Parasite	0	0	0.00
Collector-gatherer	16	132	43.71
Collector-filterer	4	11	3.64
Macrophyte-herbivore	1	10	3.31
Piercer-herbivore	0	0	0.00
Scraper	5	16	5.30
Shredder	1	1	0.33
Xylophage	0	0	0.00
Omnivore	5	126	41.72
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer	1.45
Scraper/(Scraper + C.filterer)	0.59
Shredder/Total organisms	0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
Eukiefferiella Brehmi Gr.	96	31.79
Caudatella sp.-early instar	32	10.60
Heterlimnius sp.	30	9.93
Eukiefferiella Devonica Gr.	19	6.29
Serratella tibialis	12	3.97
SUBTOTAL 5 DOMINANTS	189	62.58
Drunella coloradensis	10	3.31
Micrasema sp.	10	3.31
Polycelis coronata	9	2.98
Cinygmula sp.	8	2.65
Brachycentrus americanus	8	2.65
TOTAL DOMINANTS	234	77.48

SAPROBIC INDICES

Hilsenhoff Biotic Index	3.34
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DIVERSITY MEASURES

Shannon H (loge)	2.31
Shannon H (log2)	3.33
Evenness	0.64
Simpson D	0.12

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	116	38.25
Univoltine	138	45.53
Semivoltine	49	16.23

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	10	3.31
Intolerant	2	3	0.99
Clinger	21	146	48.34

Aquatic Invertebrate Taxonomic Data

Site Name: Twelvemile Creek

Site ID: CO4TLVMC01 8/2/01

Approx. percent of sample used: 33

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	11	3.61	4	CG
Nematoda	1	0.33	5	PA
Enchytraeidae	15	4.92	4	CG
<i>Eiseniella tetraedra</i>	7	2.30	8	CG
Total Misc. Taxa	34	11.15		
<i>Baetis tricaudatus</i>	8	2.62	6	CG
<i>Dipheter hageni</i>	3	0.98	5	CG
<i>Drunella coloradensis</i>	8	2.62	0	CG
<i>Drunella grandis</i>	1	0.33	2	CG
<i>Serratella tibialis</i>	7	2.30	2	CG
<i>Cinygmula</i> sp.	16	5.25	4	SC
<i>Epeorus longimanus</i>	9	2.95	1	SC
<i>Rhithrogena</i> sp.	8	2.62	0	SC
<i>Paraleptophlebia temporalis</i>	4	1.31	4	CG
Total Ephemeroptera	64	20.98		
<i>Zapada cinctipes</i>	2	0.66	2	SH
<i>Zapada frigida</i>	2	0.66	2	SH
<i>Kogotus</i> sp.	1	0.33	2	PR
<i>Megarcys</i> sp.	2	0.66	2	PR
<i>Pteronarcys californica</i>	1	0.33	1	OM
Total Plecoptera	8	2.62		
<i>Arctopsyche grandis</i>	4	1.31	1	PR
<i>Brachycentrus americanus</i>	19	6.23	1	OM
<i>Apatania</i> sp.	5	1.64	1	SC
<i>Rhyacophila Betteni</i> Gr.	2	0.66	1	PR
<i>Rhyacophila Brunnea</i> Gr.	2	0.66	1	PR
<i>Neophylax rickeri</i>	2	0.66	2	SC
Total Trichoptera	34	11.15		
<i>Heterlimnius</i> sp.	14	4.59	4	CG
Total Coleoptera	14	4.59		
<i>Ceratopogoninae</i>	1	0.33	6	PR
<i>Glutops</i> sp.	1	0.33	3	PR
<i>Simulium</i> sp.	17	5.57	6	CF
Total Diptera	19	6.23		
<i>Brillia</i> sp.	1	0.33	5	SH
<i>Cricotopus Bicinctus</i> Gr.	3	0.98	7	CG
<i>Cricotopus nostococladius</i>	16	5.25	3	PH
<i>Cricotopus brevipalpus</i>	3	0.98	7	CG
<i>Eukiefferiella Brehmi</i> Gr.	28	9.18	4	OM
<i>Eukiefferiella Devonica</i> Gr.	2	0.66	4	OM
<i>Micropsectra</i> sp.	45	14.75	7	CG
<i>Orthocladus</i> sp.	6	1.97	6	CG
<i>Pagastia</i> sp.	1	0.33	1	CG
<i>Polypedilum</i> sp.	1	0.33	6	OM
<i>Rheocricotopus</i> sp.	3	0.98	6	OM
<i>Rheotanytarsus</i> sp.	8	2.62	6	CF
<i>Thienemanniella</i> sp.	1	0.33	6	CG
<i>Thienemannimyia</i> Gr.	3	0.98	6	PR
<i>Tvetenia</i> sp.	11	3.61	5	CG
Total Chironomidae	132	43.28		
Grand Total	305	100.00		

Aquatic Invertebrate Summary Data

Site Name: Twelvemile Creek

Site ID: CO4TLVMC01 8/2/01

TOTAL ABUNDANCE 305
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 106

TOTAL NUMBER OF TAXA 43
Number EPT taxa 20

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	4	34	11.15
Odonata	0	0	0.00
Ephemeroptera	9	64	20.98
Plecoptera	5	8	2.62
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	6	34	11.15
Lepidoptera	0	0	0.00
Coleoptera	1	14	4.59
Diptera	3	19	6.23
Chironomidae	15	132	43.28

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.80

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	8	16	5.25
Parasite	1	1	0.33
Collector-gatherer	17	148	48.52
Collector-filterer	2	25	8.20
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	1	16	5.25
Scraper	5	40	13.11
Shredder	3	5	1.64
Xylophagc	0	0	0.00
Omnivore	6	54	17.70
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 1.60
Scraper/(Scraper + C.filterer) 0.62
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	45	14.75
<i>Eukiefferiella Brehmi</i> Gr.	28	9.18
<i>Brachycentrus americanus</i>	19	6.23
<i>Simulium</i> sp.	17	5.57
<i>Cinygmula</i> sp.	16	5.25
SUBTOTAL 5 DOMINANTS	125	40.98
<i>Cricotopus nostococladius</i>	16	5.25
Enchytraeidae	15	4.92
<i>Heterlimnius</i> sp.	14	4.59
<i>Polycelis coronata</i>	11	3.61
<i>Tvetenia</i> sp.	11	3.61
TOTAL DOMINANTS	192	62.95

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.16

DIVERSITY MEASURES

Shannon H (loge) 3.30
Shannon H (log2) 4.77
Evenness 0.88
Simpson D 0.06

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	119	39.10
Univoltine	146	47.79
Semivoltine	40	13.11

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	8	2.62
Intolerant	6	27	8.85
Clinger	21	133	43.61

Aquatic Invertebrate Taxonomic Data

Site Name: Ward Creek

Site ID: CO4WRDCR01 8/2/01

Approx. percent of sample used: 17

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	14	4.59	4	CG
Tubificidae - immature	6	1.97	9	CG
Acari	1	0.33	5	PA
Total Misc. Taxa	21	6.89		
<i>Baetis tricaudatus</i>	21	6.89	6	CG
<i>Drunella coloradensis</i>	4	1.31	0	CG
<i>Drunella doddsi</i>	27	8.85	0	CG
<i>Drunella spinifera</i>	1	0.33	0	PR
<i>Serratella tibialis</i>	3	0.98	2	CG
<i>Cinygmula</i> sp.	11	3.61	4	SC
<i>Epeorus albertae</i>	16	5.25	1	SC
<i>Epeorus longimanus</i>	2	0.66	1	SC
<i>Epeorus grandis</i>	7	2.30	0	SC
<i>Rhithrogena</i> sp.	13	4.26	0	SC
<i>Ameletus</i> sp.	1	0.33	0	CG
Total Ephemeroptera	106	34.75		
<i>Sweltsa</i> sp.	4	1.31	1	PR
<i>Despaxia augusta</i>	1	0.33	0	SH
<i>Visoka cataractae</i>	3	0.98	0	SH
<i>Zapada columbiana</i>	7	2.30	2	SH
<i>Megarcys</i> sp.	10	3.28	2	PR
<i>Yoraperla</i> sp.	14	4.59	1	SH
Total Plecoptera	39	12.79		
<i>Parapsyche elsis</i>	5	1.64	1	PR
<i>Micrasema</i> sp.	1	0.33	1	MH
<i>Glossosoma</i> sp.	5	1.64	1	SC
<i>Rhyacophila Betteni</i> Gr.	4	1.31	1	PR
<i>Rhyacophila blarina</i>	11	3.61	1	PR
<i>Rhyacophila Brunnea</i> Gr.	2	0.66	1	PR
<i>Rhyacophila narvae</i>	5	1.64	1	PR
Total Trichoptera	33	10.82		
<i>Heterlimnius</i> sp.	12	3.93	4	CG
Total Coleoptera	12	3.93		
<i>Clinocera</i> sp.	1	0.33	6	PR
<i>Hexatoma</i> sp.	1	0.33	2	PR
Total Diptera	2	0.66		
<i>Corynoneura</i> sp.	6	1.97	7	CG
<i>Eukiefferiella Brehmi</i> Gr.	18	5.90	4	OM
<i>Eukiefferiella Devonica</i> Gr.	3	0.98	4	OM
<i>Micropsectra</i> sp.	20	6.56	7	CG
<i>Orthocladius</i> sp.	5	1.64	6	CG
<i>Pagastia</i> sp.	23	7.54	1	CG
<i>Polypedilum</i> sp.	1	0.33	6	OM
<i>Rheocricotopus</i> sp.	3	0.98	6	OM
<i>Stempellinella</i> sp.	5	1.64	4	UN
<i>Thienemanniella</i> sp.	4	1.31	6	CG
<i>Thienemannimyia</i> Gr.	2	0.66	6	PR
<i>Tvetenia</i> sp.	2	0.66	5	CG
Total Chironomidae	92	30.16		
Grand Total	305	100.00		

Aquatic Invertebrate Summary Data

Site Name: Ward Creek

Site ID: CO4WRDCR01 8/2/01

TOTAL ABUNDANCE 305
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 178

TOTAL NUMBER OF TAXA 42
Number EPT taxa 24

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	21	6.89
Odonata	0	0	0.00
Ephemeroptera	11	106	34.75
Plecoptera	6	39	12.79
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	33	10.82
Lepidoptera	0	0	0.00
Coleoptera	1	12	3.93
Diptera	2	2	0.66
Chironomidae	12	92	30.16

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 1.93

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	11	46	15.08
Parasite	1	1	0.33
Collector-gatherer	14	148	48.52
Collector-filterer	0	0	0.00
Macrophyte-herbivore	1	1	0.33
Piercer-herbivore	0	0	0.00
Scraper	6	54	17.70
Shredder	4	25	8.20
Xylophage	0	0	0.00
Omnivore	4	25	8.20
Unknown	1	5	1.64

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.03

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Drunella doddsi</i>	27	8.85
<i>Pagastia</i> sp.	23	7.54
<i>Baetis tricaudatus</i>	21	6.89
<i>Micropsectra</i> sp.	20	6.56
<i>Eukiefferiella Brehmi</i> Gr.	18	5.90
SUBTOTAL 5 DOMINANTS	109	35.74
<i>Epeorus albertae</i>	16	5.25
<i>Polycelis coronata</i>	14	4.59
<i>Yoraperla</i> sp.	14	4.59
<i>Rhithrogena</i> sp.	13	4.26
<i>Heterlimnius</i> sp.	12	3.93
TOTAL DOMINANTS	178	58.36

SAPROBIC INDICES

Hilsenhoff Biotic Index 2.82

DIVERSITY MEASURES

Shannon H (loge) 3.34
Shannon H (log2) 4.82
Evenness 0.89
Simpson D 0.04

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	100	32.70
Univoltine	177	58.11
Semivoltine	28	9.18

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	21	6.89
Intolerant	7	47	15.41
Clinger	21	155	50.82

Aquatic Invertebrate Taxonomic Data

Site Name: Ward Creek

Site ID: CO4WardC02 8/2/01

Approx. percent of sample used: 83

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	2	0.60	4	CG
Tubificidae - immature	2	0.60	9	CG
<i>Eclipidrilus</i> sp.	2	0.60	8	CG
Total Misc. Taxa	6	1.80		
<i>Baetis tricaudatus</i>	3	0.90	6	CG
<i>Drunella grandis</i>	1	0.30	2	CG
<i>Serratella tibialis</i>	13	3.89	2	CG
<i>Cinygmula</i> sp.	42	12.57	4	SC
<i>Epeorus</i> sp.-early instar	15	4.49	0	SC
<i>Rhithrogena</i> sp.	1	0.30	0	SC
<i>Ameletus</i> sp.	6	1.80	0	CG
Total Ephemeroptera	81	24.25		
<i>Capnia</i> sp.	10	2.99	1	SH
<i>Kathroperla perdita</i>	1	0.30	0	PR
<i>Paraperla</i> sp.	1	0.30	0	PR
<i>Suwallia</i> sp.	1	0.30	0	PR
<i>Sweltsa</i> sp.	6	1.80	1	PR
<i>Despaxia augusta</i>	3	0.90	0	SH
<i>Zapada columbiana</i>	2	0.60	2	SH
<i>Kogotus</i> sp.	2	0.60	2	PR
<i>Megarcys</i> sp.	3	0.90	2	PR
Total Plecoptera	29	8.68		
Arctopsychinae - early instars	1	0.30	2	PR
<i>Apatania</i> sp.	21	6.29	1	SC
<i>Dicosmoecus gilvipes</i>	1	0.30	2	SC
<i>Ecclisomyia</i> sp.	54	16.17	2	OM
<i>Rhyacophila Angelita</i> Gr.	1	0.30	0	PR
<i>Rhyacophila Betteni</i> Gr.	2	0.60	1	PR
<i>Rhyacophila narvae</i>	1	0.30	1	PR
Total Trichoptera	81	24.25		
<i>Heterlimnius</i> sp.	68	20.36	4	CG
Total Coleoptera	68	20.36		
Ceratopogoninae	1	0.30	6	PR
<i>Clinocera</i> sp.	1	0.30	6	PR
Total Diptera	2	0.60		
<i>Diamesa</i> sp.	2	0.60	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	9	2.69	4	OM
<i>Heleniella</i> sp.	1	0.30	6	UN
<i>Micropsectra</i> sp.	3	0.90	7	CG
<i>Microtendipes</i> sp.	13	3.89	6	CG
<i>Orthocladius</i> sp.	16	4.79	6	CG
<i>Pagastia</i> sp.	21	6.29	1	CG
<i>Thienemannimyia</i> Gr.	2	0.60	6	PR
Total Chironomidae	67	20.06		
Grand Total	334	100.00		

Aquatic Invertebrate Summary Data

Site Name: Ward Creek

Site ID: CO4WardC02 8/2/01

TOTAL ABUNDANCE 334
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 191

TOTAL NUMBER OF TAXA 37
Number EPT taxa 23

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	3	6	1.80
Odonata	0	0	0.00
Ephemeroptera	7	81	24.25
Plecoptera	9	29	8.68
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	81	24.25
Lepidoptera	0	0	0.00
Coleoptera	1	68	20.36
Diptera	2	2	0.60
Chironomidae	8	67	20.06

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 2.85

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	13	23	6.89
Parasite	0	0	0.00
Collector-gatherer	13	152	45.51
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	5	80	23.95
Shredder	3	15	4.49
Xylophage	0	0	0.00
Omnivore	2	63	18.86
Unknown	1	1	0.30

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.01

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Heterlimnius</i> sp.	68	20.36
<i>Ecclisomyia</i> sp.	54	16.17
<i>Cinygmula</i> sp.	42	12.57
<i>Apatania</i> sp.	21	6.29
<i>Pagastia</i> sp.	21	6.29
SUBTOTAL 5 DOMINANTS	206	61.68
<i>Orthocladus</i> sp.	16	4.79
<i>Epeorus</i> sp.-early instar	15	4.49
<i>Serratella tibialis</i>	13	3.89
<i>Microtendipes</i> sp.	13	3.89
<i>Capnia</i> sp.	10	2.99
TOTAL DOMINANTS	273	81.74

SAPROBIC INDICES

Hilsenhoff Biotic Index 2.95

DIVERSITY MEASURES

Shannon H (loge) 2.38
Shannon H (log2) 3.43
Evenness 0.66
Simpson D 0.09

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	55	16.32
Univoltine	208	62.28
Semivoltine	72	21.41

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	3	0.90
Intolerant	8	87	26.05
Clinger	17	228	68.26

Aquatic Invertebrate Taxonomic Data

Site Name: North Fork Little Joe Creek

Site ID: NF Little Joe 1 7/26/01

Approx. percent of sample used: 15

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	12	4.03	4	CG
Tubificidae - immature	10	3.36	9	CG
Total Misc. Taxa	22	7.38		
<i>Baetis tricaudatus</i>	2	0.67	6	CG
<i>Caudatella</i> sp.-early instar	5	1.68	1	CG
<i>Drunella coloradensis</i>	3	1.01	0	CG
<i>Drunella doddsi</i>	4	1.34	0	CG
<i>Drunella spinifera</i>	7	2.35	0	PR
<i>Serratella tibialis</i>	8	2.68	2	CG
<i>Epeorus albertae</i>	13	4.36	1	SC
<i>Epeorus grandis</i>	3	1.01	0	SC
<i>Rhithrogena</i> sp.	14	4.70	0	SC
<i>Paraleptophlebia</i> sp.	1	0.34	4	CG
<i>Ameletus</i> sp.	1	0.34	0	CG
Total Ephemeroptera	61	20.47		
Capniidae - early instars	1	0.34	1	SH
<i>Sweltsa</i> sp.	1	0.34	1	PR
<i>Despaxia augusta</i>	1	0.34	0	SH
<i>Zapada columbiana</i>	12	4.03	2	SH
<i>Doroneuria</i> sp.	1	0.34	1	PR
<i>Megarcys</i> sp.	2	0.67	2	PR
<i>Yoraperla</i> sp.	10	3.36	1	SH
Total Plecoptera	28	9.40		
<i>Parapsyche elsis</i>	5	1.68	1	PR
<i>Glossosoma</i> sp.	2	0.67	1	SC
<i>Rhyacophila</i> Betteni Gr.	1	0.34	1	PR
<i>Rhyacophila blarina</i>	3	1.01	1	PR
<i>Rhyacophila Brunnea</i> Gr.	1	0.34	1	PR
<i>Rhyacophila narvae</i>	1	0.34	1	PR
<i>Neothremma</i> sp.	7	2.35	0	SC
Total Trichoptera	20	6.71		
<i>Heterlimnius</i> sp.	1	0.34	4	CG
Total Coleoptera	1	0.34		
<i>Clinocera</i> sp.	1	0.34	6	PR
<i>Oreogeton</i> sp.	1	0.34	6	PR
<i>Glutops</i> sp.	1	0.34	3	PR
Total Diptera	3	1.01		
<i>Brillia</i> sp.	2	0.67	5	SH
<i>Corynoneura</i> sp.	1	0.34	7	CG
<i>Diamesa</i> sp.	3	1.01	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	19	6.38	4	OM
<i>Eukiefferiella Devonica</i> Gr.	1	0.34	4	OM
<i>Micropsectra</i> sp.	72	24.16	7	CG
<i>Orthocladius</i> sp.	17	5.70	6	CG
<i>Pagastia</i> sp.	40	13.42	1	CG
<i>Parametriocnemus</i> sp.	1	0.34	5	CG
<i>Rheocricotopus</i> sp.	2	0.67	6	OM
<i>Tvetenia</i> sp.	5	1.68	5	CG
Total Chironomidae	163	54.70		
Grand Total	298	100.00		

Aquatic Invertebrate Summary Data

Site Name: North Fork Little Joe Creek

Site ID: NF Little Joe 1 7/26/01

TOTAL ABUNDANCE 298

Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 109

TOTAL NUMBER OF TAXA 42
Number EPT taxa 25

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	22	7.38
Odonata	0	0	0.00
Ephemeroptera	11	61	20.47
Plecoptera	7	28	9.40
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	7	20	6.71
Lepidoptera	0	0	0.00
Coleoptera	1	1	0.34
Diptera	3	3	1.01
Chironomidae	11	163	54.70

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.67

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	12	25	8.39
Parasite	0	0	0.00
Collector-gatherer	17	186	62.42
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	5	39	13.09
Shredder	5	26	8.72
Xylophage	0	0	0.00
Omnivore	3	22	7.38
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.03

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Micropsectra</i> sp.	72	24.16
<i>Pagastia</i> sp.	40	13.42
<i>Eukiefferiella</i> Brehmi Gr.	19	6.38
<i>Orthocladius</i> sp.	17	5.70
<i>Rhithrogena</i> sp.	14	4.70
SUBTOTAL 5 DOMINANTS	162	54.36
<i>Epeorus albertae</i>	13	4.36
<i>Polycelis coronata</i>	12	4.03
<i>Zapada columbiana</i>	12	4.03
Tubificidae - immature	10	3.36
<i>Yaraperla</i> sp.	10	3.36
TOTAL DOMINANTS	219	73.49

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.56

DIVERSITY MEASURES

Shannon H (loge) 2.92
Shannon H (log2) 4.21
Evenness 0.78
Simpson D 0.10

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	136	45.55
Univoltine	152	51.09
Semivoltine	10	3.36

	#TAXA	ABUNDANCE	PERCENT
Tolerant	1	2	0.67
Intolerant	10	43	14.43
Clinger	18	84	28.19

Aquatic Invertebrate Taxonomic Data

Site Name: North Fork Little Joe Creek

Site ID: NF Little Joe 2 7/26/01

Approx. percent of sample used: 100

Taxon	Quantity	Percent	HBI	FFG
Tubificidae - immature	17	7.76	9	CG
Total Misc. Taxa	17	7.76		
<i>Baetis tricaudatus</i>	3	1.37	6	CG
<i>Diphetor hageni</i>	1	0.46	5	CG
<i>Drunella coloradensis</i>	8	3.65	0	CG
<i>Drunella doddsi</i>	3	1.37	0	CG
<i>Serratella tibialis</i>	22	10.05	2	CG
<i>Cinygmula</i> sp.	22	10.05	4	SC
<i>Epeorus</i> sp.-early instar	21	9.59	0	SC
<i>Epeorus longimanus</i>	18	8.22	1	SC
<i>Epeorus grandis</i>	1	0.46	0	SC
<i>Rhithrogena</i> sp.	4	1.83	0	SC
<i>Ameletus</i> sp.	3	1.37	0	CG
Total Ephemeroptera	106	48.40		
<i>Suwallia</i> sp.	3	1.37	0	PR
<i>Visoka cataractae</i>	1	0.46	0	SH
<i>Zapada columbiana</i>	14	6.39	2	SH
<i>Kogotus</i> sp.	1	0.46	2	PR
<i>Megarcys</i> sp.	6	2.74	2	PR
Total Plecoptera	25	11.42		
<i>Brachycentrus americanus</i>	2	0.91	1	OM
<i>Lepidostoma</i> sp.-panel case larvae	4	1.83	1	SH
<i>Lepidostoma</i> sp.-turret case larvae	3	1.37	2	SH
<i>Dicasmoeus gilvipes</i>	1	0.46	2	SC
<i>Psychoglypha</i> sp.	1	0.46	0	OM
<i>Dolophilodes</i> sp.	1	0.46	2	CF
<i>Rhyacophila</i> Angelita Gr.	2	0.91	0	PR
<i>Rhyacophila</i> Betteni Gr.	2	0.91	1	PR
Total Trichoptera	16	7.31		
<i>Heterlimnius</i> sp.	5	2.28	4	CG
<i>Lara avara</i>	10	4.57	4	SH
<i>Narpus</i> sp.	3	1.37	4	CG
Total Coleoptera	18	8.22		
<i>Dicranota</i> sp.	1	0.46	3	PR
Total Diptera	1	0.46		
<i>Brillia</i> sp.	1	0.46	5	SH
<i>Corynoneura</i> sp.	7	3.20	7	CG
<i>Eukiefferiella</i> Pseudomontana Gr.	1	0.46	8	OM
<i>Micropsectra</i> sp.	16	7.31	7	CG
<i>Pagastia</i> sp.	4	1.83	1	CG
<i>Symposiocladius</i> sp.	1	0.46	5	SH
<i>Tvetenia</i> sp.	6	2.74	5	CG
Total Chironomidae	36	16.44		
Grand Total	219	100.00		

Aquatic Invertebrate Summary Data

Site Name: North Fork Little Joe Creek

Site ID: NF Little Joe 2 7/26/01

TOTAL ABUNDANCE 219
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 147

TOTAL NUMBER OF TAXA 36
Number EPT taxa 24

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	1	17	7.76
Odonata	0	0	0.00
Ephemeroptera	11	106	48.40
Plecoptera	5	25	11.42
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	8	16	7.31
Lepidoptera	0	0	0.00
Coleoptera	3	18	8.22
Diptera	1	1	0.46
Chironomidae	7	36	16.44

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 4.08

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	6	15	6.85
Parasite	0	0	0.00
Collector-gatherer	13	98	44.75
Collector-filterer	1	1	0.46
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	6	67	30.59
Shredder	7	34	15.53
Xylophage	0	0	0.00
Omnivore	3	4	1.83
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer 67.00
Scraper/(Scraper + C.filterer) 0.99
Shredder/Total organisms 0.07

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Serratella tibialis</i>	22	10.05
<i>Cinygmula</i> sp.	22	10.05
<i>Epeorus</i> sp.-early instar	21	9.59
<i>Epeorus longimanus</i>	18	8.22
Tubificidae - immature	17	7.76
SUBTOTAL 5 DOMINANTS	100	45.66
<i>Micropsectra</i> sp.	16	7.31
<i>Zapada columbiana</i>	14	6.39
<i>Lara avara</i>	10	4.57
<i>Drunella coloradensis</i>	8	3.65
<i>Corynoneura</i> sp.	7	3.20
TOTAL DOMINANTS	155	70.78

SAPROBIC INDICES

Hilsenhoff Biotic Index 3.08

DIVERSITY MEASURES

Shannon H (loge) 2.73
Shannon H (log2) 3.93
Evenness 0.76
Simpson D 0.07

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	30	13.70
Univoltine	167	76.03
Semivoltine	23	10.27

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	4	1.83
Intolerant	6	24	10.96
Clinger	17	131	59.82

Aquatic Invertebrate Taxonomic Data

Site Name: Little Joe Creek

Site ID: Little Joe 2 7/26/01

Approx. percent of sample used: 6

Taxon	Quantity	Percent	HBI	FFG
<i>Polycelis coronata</i>	1	0.32	4	CG
Tubificidae - immature	18	5.84	9	CG
Total Misc. Taxa	19	6.17		
<i>Acentrella turbida</i>	2	0.65	4	CG
<i>Baetis tricaudatus</i>	1	0.32	6	CG
<i>Dipheter hageni</i>	1	0.32	5	CG
<i>Drunella coloradensis</i>	7	2.27	0	CG
<i>Serratella tibialis</i>	1	0.32	2	CG
<i>Cinygmula</i> sp.	10	3.25	4	SC
<i>Epeorus albertae</i>	2	0.65	1	SC
<i>Epeorus longimanus</i>	4	1.30	1	SC
<i>Rhithrogena</i> sp.	1	0.32	0	SC
Total Ephemeroptera	29	9.42		
<i>Sweltsa</i> sp.	5	1.62	1	PR
<i>Zapada columbiana</i>	4	1.30	2	SH
Total Plecoptera	9	2.92		
<i>Parapsyche elsis</i>	1	0.32	1	PR
<i>Brachycentrus americanus</i>	3	0.97	1	OM
<i>Apatania</i> sp.	1	0.32	1	SC
<i>Rhyacophila Betteni</i> Gr.	1	0.32	1	PR
<i>Rhyacophila Brunnea</i> Gr.	1	0.32	1	PR
Total Trichoptera	7	2.27		
<i>Chelifera</i> sp.	1	0.32	6	PR
<i>Clinocera</i> sp.	7	2.27	6	PR
<i>Limnophora</i> sp.	1	0.32	6	PR
<i>Antocha</i> sp.	1	0.32	3	CG
Total Diptera	10	3.25		
<i>Diamesa</i> sp.	9	2.92	5	CG
<i>Eukiefferiella Brehmi</i> Gr.	27	8.77	4	OM
<i>Eukiefferiella Devonica</i> Gr.	8	2.60	4	OM
<i>Micropsectra</i> sp.	26	8.44	7	CG
<i>Orthocladius</i> sp.	116	37.66	6	CG
<i>Pagastia</i> sp.	47	15.26	1	CG
<i>Thienemanniella</i> sp.	1	0.32	6	CG
Total Chironomidae	234	75.97		
Grand Total	308	100.00		

Aquatic Invertebrate Summary Data

Site Name: Little Joe Creek

Site ID: Little Joe 2 7/26/01

TOTAL ABUNDANCE 308
Ephemeroptera + Plecoptera +
Trichoptera (EPT) abundance 45

TOTAL NUMBER OF TAXA 29
Number EPT taxa 16

TAXONOMIC GROUP COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Misc. Taxa	2	19	6.17
Odonata	0	0	0.00
Ephemeroptera	9	29	9.42
Plecoptera	2	9	2.92
Hemiptera	0	0	0.00
Megaloptera	0	0	0.00
Trichoptera	5	7	2.27
Lepidoptera	0	0	0.00
Coleoptera	0	0	0.00
Diptera	4	10	3.25
Chironomidae	7	234	75.97

RATIOS OF TAX GROUP ABUNDANCES

EPT/Chironomidae 0.19

FUNCTIONAL FEEDING GROUP (FFG) COMPOSITION

GROUP	#TAXA	ABUNDANCE	PERCENT
Predator	7	17	5.52
Parasite	0	0	0.00
Collector-gatherer	13	231	75.00
Collector-filterer	0	0	0.00
Macrophyte-herbivore	0	0	0.00
Piercer-herbivore	0	0	0.00
Scraper	5	18	5.84
Shredder	1	4	1.30
Xylophage	0	0	0.00
Omnivore	3	38	12.34
Unknown	0	0	0.00

RATIOS OF FFG ABUNDANCES

Scraper/Collector-filterer #DIV/0!
Scraper/(Scraper + C.filterer) 1.00
Shredder/Total organisms 0.00

CONTRIBUTION OF DOMINANT TAXA

TAXON	ABUNDANCE	PERCENT
<i>Orthocladus</i> sp.	116	37.66
<i>Pagastia</i> sp.	47	15.26
<i>Eukiefferiella</i> Brehmi Gr.	27	8.77
<i>Micropsectra</i> sp.	26	8.44
Tubificidae - immature	18	5.84
SUBTOTAL 5 DOMINANTS	234	75.97
<i>Cinygmula</i> sp.	10	3.25
<i>Diamesa</i> sp.	9	2.92
<i>Eukiefferiella</i> Devonica Gr.	8	2.60
<i>Drunella coloradensis</i>	7	2.27
<i>Clinocera</i> sp.	7	2.27
TOTAL DOMINANTS	275	89.29

SAPROBIC INDICES

Hilsenhoff Biotic Index 4.63

DIVERSITY MEASURES

Shannon H (loge) 2.26
Shannon H (log2) 3.25
Evenness 0.67
Simpson D 0.19

COMMUNITY VOLTINISM ANALYSIS

TYPE	ABUNDANCE	PERCENT
Multivoltine	180	58.28
Univoltine	124	40.10
Semivoltine	5	1.62

	#TAXA	ABUNDANCE	PERCENT
Tolerant	2	2	0.65
Intolerant	3	6	1.95
Clinger	13	40	12.99